Version: 19 May 2002

Appendix E

Affected Environment -

King County

Affected Environment - King County

This Appendix provides supplemental information for Affected Environment – Region 2, specific to King County. This Appendix was prepared by King County Surface Water Engineering and Environmental Services for the U.S. Army Corps of Engineers, Seattle District, Regulatory Branch.

Geographic boundaries:

- Snohomish watershed (WRIA 7) - only the Snoqualmie River and a small portion of the upper Skykomish River are within King County.
- Lake Washington/Sammamish Watershed (WRIA 8) - all within King County
- Central Puget Sound (often included in WRIA 8) - all within King County
- Duwamish Watershed (WRIA 9 - Green/Duwamish River) -all within King County
- Lower Puget Sound (often included in WRIA 9) - all within King County
- Puyallup Watershed (WRIA 10) - only the White River is within King County

Species Present:

As of January 2001, the following is the complete list of endangered, threatened, and proposed species, and critical habitat found within King County.

<u>Endangered</u>
Gray wolf (*Canis Lupus*)
Marsh sandwort (*Arenaria paludicola)*

<u>Threatened</u>
Grizzly bear (*Ursus arctos*)
Canada lynx (*Lynx canadensis*)
Chinook salmon, Puget Sound ESU (*Oncorhynchus tshawytscha*)
Bull trout, Puget Sound DPS (*Salvelinus confluentus*)
Bald Eagle (*Haliaeetus leucocephalus*)
Marbled murrelet (*Brachyramphus marmoratus*)
Northern spotted owl (*Strix occidentalis*)
Water howellia (*Howellia aquatilis*)
Golden paintbrush (*Castilleja levisecta*)

<u>Proposed</u> - Dolly Varden trout (due to similarity of appearance to bull trout; no Section 7 protection)

<u>Designated</u>
Critical habitat for Puget Sound chinook salmon ESU
Critical habitat for the marbled murrelet
Critical habitat for the northern spotted owl

Several of the species listed above are very unlikely to be found within or near most project areas (see list below). The reasoning behind these determinations, descriptions of the distribution of populations and suitable habitat currently within King County and how this relates to the distribution of habitat restoration projects within the County can be found in Table E-1.

Plants
Marsh sandwort - E
Water howellia -T
Golden paintbrush -T

Mammals
Gray wolf - E
Grizzy bear - T
Canada lynx -T

The remainder of the listed or proposed species and critical habitat within King County may be affected by habitat restoration activities within King County. Projects that are implemented in rural areas are more likely to encounter Listed/Candidate species and critical habitat than projects in the urban environment. King County's official boundary between the rural and urban service areas of the Surface Water Program will be used to determine if a project falls within an urban or rural area. The following proposed species lists for projects implemented in each area are subject to change upon site specific surveys and research:

Urban Areas	Rural Areas
Chinook salmon, Puget Sound ESU	Chinook salmon, Puget Sound ESU
Chinook salmon critical habitat	Chinook salmon critical habitat
Bull trout, Puget Sound DPS	Bull trout, Puget Sound DPS
Bald Eagle	Bald Eagle
	Marbled Murrelet
	Marbled Murrelet critical habitat
	Northern spotted owl
	Northern spotted owl critical habitat

Typical Land-Use Activities and Associated Impacts to Listed Species:

Much of the information contained in this section was compiled from the following documents, except where otherwise noted:

- "*Initial Snohomish River Basin Chinook Salmon Conservation/Recovery Technical Work Plan*" (Snohomish Basin Salmonid Recovery Technical Committee, 1999).
- *Salmon Habitat Limiting factors Report for the Puyallup River Basin* (Kerwin, 1999).

- *"Habitat Limiting Factors and Reconnaissance Assessment Report, Green/Duwamish and Central Puget Sound Watersheds (WRIA 9 and Vashon Island)."(* Kerwin and Nelson, 2000)
- *"Proposed Lower Cedar River Basin and Nonpoint Pollution Action Plan"* (KC-DNR, 1996)
- *"Cedar River Current and Future Conditions Report*" (King County Department of Public Works, Surface Water Management Division. 1993)

Many factors may limit the performance of listed species in King County. This section will describe the activities associated with the three major land-use categories found within King County (urban and rural development, agricultural production, and timber harvest) that have negative impacts on listed species and will also describe these impacts.

The headwaters of King County's major watersheds are located in the primarily managed forests of the Cascade Mountains and foothills, which dominate the eastern two-thirds of the county. As these drainages descend towards Puget Sound through the western third of the county they encounter increasing levels of agriculture, development and urbanization. Between the Cascade foothills and Puget Sound, land use is a mixture of urban, residential and agricultural coverage, with residential development especially spreading up the previously rural floodplains and surrounding uplands of the major rivers. The tidewaters of each of these watersheds are surrounded by heavily urbanized areas and development has degraded or eliminated valuable wetland and estuarine habitat.

URBAN AND RURAL DEVELOPMENT

Urban and rural development of the watersheds in King County has impaired habitat directly by altering the physical, biological and chemical characteristics of the landscape. Activities associated with development and some of their *potential* impacts to listed fish species and critical habitat include:

<u>Bank Hardening, Diking, and Dredging</u>

- The construction of levees and dikes in lowland areas disconnected floodplain habitat from the mainstems of many of the larger rivers and estuaries;
- Rip-rapping, diking and dredging continue to confine river channels to their present courses and prevent water from flowing over the floodplain, resulting in further disconnection of the rivers and floodplains and disruption of natural processes;
- Channelization and straightening result in a net loss of stream length and a corresponding loss of hydraulic diversity and aquatic productivity within the remaining reach, thereby substantially reducing its value as fish habitat (Moyle, 1976);
- Channelization also impairs energy dissipation and therefore increases the sediment transport capacity of the main channel. This may result in unnaturally coarse substrate materials that are unsuitable for salmonid spawning or other life stages;

- Fine sediments from upstream reaches cannot be spread out onto the floodplains and therefore remain in the channel and settle out, covering and embedding spawning gravel and affecting the production of aquatic macroinvertebrates (Cederholm and Lestelle, 1974; Reiser and Bjorn, 1979);
- Where dredging is initiated to remove these fine sediments, chronic turbidity in reaches downstream of the dredging activities may affect fish behavior and health (reduced foraging efficiency, growth and survival and potentially causing gill trauma; (Sigler, 1980));
- Bank hardening and construction of dikes and levees also restrict natural river processes that form gravel bars, side-channels and sloughs necessary for successful salmon spawning and rearing;
- By limiting flooding and channel migration, diking and dredging may prevent rivers from naturally recruiting woody debris to the channel and channel banks, possibly impairing the processes that support normal patterns of vegetational succession on the floodplain and possibly diminishing the health and species complexity of the riparian zone. Fish spawning and rearing habitat may also be impaired by this lack of large woody debris (LWD) recruitment;
- The installation of flood or tide gates in dikes may limit fish access to and from many valley bottom tributaries and sloughs that provide important summer rearing and winter refuge habitat for juvenile salmon.

<u>Road Construction</u>

- In the many areas where roads are constructed throughout the floodplain and adjacent to streams, many of the effects discussed above for *"Bank Hardening, Diking and Dredging*" may apply to road construction (e.g. disconnecting rivers from floodplains, restricting natural processes, channelization etc.);
- Road construction has, in the past, created fish passage barriers that restrict or prevent access to suitable spawning and rearing habitat;
- Construction and maintenance of roads and associated ditches may cause chronic turbidity in downstream reaches, which may affect fish behavior and health (reduced foraging efficiency, growth and survival, gill trauma) or potentially killing fish at very high turbidity levels;
- Oil and other pollutants in the runoff from roads contributes to the degradation of water quality seen in many streams and rivers, possibly affecting both spawning and rearing habitat (see water quality section below);
- Road construction increases the amount of impervious surface area in the watersheds, possibly causing impacts to fish and fish habitat as discussed in the "*Commercial and Residential Construction*" section;
- See *Timber Harvest* section for further discussion of impacts of road construction in steep terrain.

<u>Commercial and Residential Construction</u>

Low, medium and high density residential development, business parks, schools, shopping centers, other commercial and industrial development and associated roads may result in:

- Increased impervious surface area and the associated increase in surface runoff, which in turn may have the following consequences and potential impacts to listed fish species and critical habitat:
  - Rivers and small streams are flashier and prone to larger and more frequent flooding, affecting habitat and the survival and fitness of spawning and rearing fish;
  - In streams deficient in structural elements (LWD or boulders), stream channels may erode vertically, further disconnecting them from their floodplains, lowering local water tables, and causing sedimentation and aggradation as well as turbidity downstream, suffocating or entombing incubating eggs and hatched alevins, reducing the quality of downstream spawning habitat and pools, affecting diversity and abundance of aquatic macroinvertebrates and affecting fish behavior and health (reduced foraging efficiency, growth and survival, gill trauma);
  - Summer low flows may be permanently reduced by reducing the recharge to groundwater, constricting the amount of available rearing habitat, increasing inter and intra-species competition, increasing vulnerability to predation, and allowing stream temperatures to increase above normal preference and tolerance ranges;
  - Increased measures to control flooding (bank hardening, channelization, etc.) that may have negative effects on habitat and fish (see *Bank Hardening, Diking, and Dredging*).
- Substantial filling and grading of floodplain riparian wetland habitat –possibly eliminating aquatic habitat, removing an important sink for pollutants carried in upland runoff and reducing recharge to groundwater (see above), all of which may affect spawning and rearing potential for fish;
- Increased chemical and nutrient pollutants in the surface water runoff and in the groundwater around these areas, possibly affecting both spawning and rearing potential for fish (see "*Water Quality Contamination*" section).

<u>Water Quality Contamination</u>

Many activities associated with urban and rural development have resulted in adverse impacts to water quality in King County. In some areas, such as the Snohomish River estuarine zone, contaminant contributions are decreasing as industrial activity has declined and municipal sewage treatment has improved in recent decades. However, in many areas, past and present contributions of water quality contaminants are still a major problem. Poor water quality may kill fish or render existing habitat useless for spawning and/or rearing, depending on the magnitude of the pollution.

Waterbodies in areas of urban and rural development areas listed under Section 303(d) of the Clean Water Act as impaired for temperature exceedences, low dissolved oxygen, high fecal coliform, and various chemical and metal contaminants associated with industry are shown in Table E-4. The listings in the lower portions of the watershed are likely the result of contaminants from all land-uses discussed here including agricultural production and timber harvest. Urban and rural development may contribute to all of the aforementioned impairments to water quality through:

- Increased chemical and nutrient pollutants in the surface water runoff and groundwater around these areas (oil from cars, gasoline from gas stations, soaps from washing cars, lawn fertilizers, etc.);
- Clearing of riparian vegetation (temperature) and destruction of wetlands and their bio-filtering capacity;
- Increased septic and sewer discharge;
- Increased temperature of surface water runoff from precipitation falling and flowing over pavement versus natural substrate;
- Introduction of industrial waste products.

Dams and Water Diversion

Urban and rural development brings with it the demand for more water, electricity and the need for flood control. Dams have been built by various entities on most of the major river systems and some smaller tributaries in King County to generate electricity, supply water and control flooding in urban and rural areas. The "Watershed Description" section of this document describes the major dams and diversions in each of the watersheds within King County. The physical structure of dams and the regulation of flow at the dams and diversions may have major consequences and potential impacts on fish, including:

- Many dams present barriers to anadromous fish migration, permanently eliminating valuable upstream rearing and spawning habitat for anadromous fish populations. For example, the water diversion dam at river mile 21.3 on the Cedar River prevents anadromous fish from using an additional 14 miles of the upper watershed;
- Downstream transport of streambed and structural materials is blocked by dams, interrupting the natural recruitment of spawning gravel, LWD and other components necessary for formation of quality fish habitat downstream;
- Sudden fluctuations in flow may wash away deposited eggs or leave them, crustaceans and other aquatic life stranded out of water (e.g. Puget Sound Energy - Baker River, Nov. 2000),possibly affecting basin-wide mortality;
- Regulation of flow alters the natural flow regime, which may influence oxygen levels, temperature, suspended solids, drift of organisms, and cycling of organic matter and other nutrients –all of which affect productivity of downstream fish habitat;
- Diversion of water during combined with water withdrawal from domestic wells during critical summer low flow periods may result in summer low flow conditions that are much lower than would be expected under natural conditions and lead to displacement of fish from preferred habitat (thermal barriers), mortality by stranding in side-channel habitat and reduction in the total available rearing habitat habitat (e.g. Current low flow conditions from July through October in the lower Cedar River are on average from 9 to 40% less than pre-dam conditions (King County 1993));
- Late-summer low flows and associated shallow, warm water may affect the spawning success and distribution of listed fish species.

There are also numerous smaller structures built in King County to control stormwater runoff that may in some cases have similar physical and biological effects, but on a much smaller scale. Most of these structures are constructed independent from the main channel of the streams and benefit habitat and listed species by buffering streams from peak flows and removing sediment and pollutants from the system. The older stormwater control structures that were built within stream channels may have detrimental effects similar to those listed above.

Water Related Recreational Usage

Almost all of King County's major lakes and rivers are used for recreation in some form by the County's residents. Recreational uses range from boating of all sorts (King County is reputed to have the highest ownership of boats per capita in the nation), swimming and diving to fishing and waterfowl hunting. In addition to the direct effects of these activities (summarized below) are those of the equipment and infrastructure that support the activities. Waterfront docks and marinas, jetties, fueling stations, swimming beaches and even artificially impounded ponds for water skiing and fishing all have effects upon aquatic habitat. The high value placed upon access to water bodies for recreational purposes also encourages waterfront development which has its own litany of impacts. While the indirect effects of water-related recreation may be too numerous and dilute to list, direct effects may include:

- The potential for direct human contact with listed species;
- The potential for direct human modification of habitat such as spawning gravels or pool-forming logs;
- Noise and pollution caused by motor-driven watercraft;
- The potential for toxic fuel spills from motor-driven watercraft;
- Litter and debris that may cause harm to listed species.

Potential Impacts to Listed Bird Species and Critical Habitat

Activities associated with urban and rural development and some of their potential impacts to listed bird species and critical habitat include:

- Expansion into rural areas and the associated conversion of forested lands to low, medium and high density residential development, business parks, schools, shopping centers and other commercial and industrial development reduces the amount of nesting, perching and forage areas;
- Removal of vegetation also contributes to the fragmentation of habitat and impairment of existing habitat corridors;
- Increases chemical contamination in forage species may affect survival and/or breeding success;
- See *Timber Harve*st section for more impacts of pre-development timber harvest on listed bird species.

AGRICULTURAL PRODUCTION

The lowland reaches of most major streams and rivers within King County have been degraded to some extent by the development of agriculture throughout the active floodplains and adjacent to the active channels. Large portions of the Snoqualmie, Cedar and Green River watersheds have been altered by diking and land-clearing associated with cultivating soil, producing crops and raising livestock – all components of agriculture. Most of the large-scale channel and riparian modifications were completed during the initial development of agriculture throughout King County. What were once diverse complexes of interconnected stream and river channels, floodplains and associated off-channel and wetland habitats are in many areas now confined to single, narrow channels with degraded habitat attributes and minimal connections to their original floodplains. These past modifications combined with ongoing agricultural use of these lands have limited the performance of fish stocks in King County.

There are numerous factors limiting the performance of fish stocks in King County that could result from agricultural land-use. The degree of the impact will depend on the type (e.g. dairy vs. crop), size and location of the farm. Agricultural activities and some of their *potential* impacts to listed fish species and critical habitat include:

- Widespread removal of the riparian vegetation may reduce bank stability, cover, shade, habitat for aquatic macroinvertebrates and LWD recruitment, thereby possibly affecting both spawning and rearing habitat;
- Removal of riparian vegetation may allow invasive plants (e.g. reed canary grass, blackberry, yellow iris, etc.) to establish and impair the natural functions and values of the riparian corridor and surrounding wetlands;
- Erosion and subsequent sedimentation/aggradation downstream may: suffocate or entomb incubating eggs and hatched alevins, reduce the quality of downstream spawning habitat and pools and affect diversity and abundance of aquatic macroinvertebrates (i.e. rearing potential);
- Stream access by livestock may result in mortality through the trampling of redds;
- Chronic turbidity in downstream reaches associated with bank erosion or regular livestock access to the stream, may affect fish behavior and health (reduced foraging efficiency, growth and survival, gill trauma);
- Pesticides, herbicides and livestock wastes coming from agriculture sites may degrade downstream water quality (see Table E-4);
- Rerouting and channelization of natural stream reaches may reduce the total stream length and the hydraulic diversity and aquatic productivity within the remaining reach, possibly reducing its value as fish habitat;
- Filling and grading within the floodplain, combined with channelization and rerouting of natural stream reaches, may result in reductions of, and minimal connections to, off-channel pond and wetland rearing habitat.

Many streams in the areas dominated by agricultural activities are listed under Section 303(d) of the Clean Water Act as impaired for temperature exceedences, low dissolved oxygen levels, high fecal coliform levels and high nutrient levels. In lowland areas of King County watersheds, agricultural activities may contribute to these various pollutants.

Potential Impacts to Listed Bird Species and Critical Habitat

Agricultural activities and some of their potential impacts to listed bird species and critical habitat include:

- Removal of vegetation and conversion to monoculture habitats reduces the amount of nesting, perching and forage areas;
- Removal of vegetation also contributes to the fragmentation of habitat and impairment of existing habitat corridors;
- Increases chemical contamination in forage species may affect survival and/or breeding success.

TIMBER HARVEST

Timber harvest preceded the industrial, commercial, residential and agricultural development of the western third of King County during the past century. Today, commercial timber harvest continues mainly in the eastern two-thirds of the County from the foothills of the Cascade Mountains to the Cascade Crest. Very little old-growth forest remains in the County, except for those areas that are protected (see *Protected Areas*). Poor road building and forest management practices of the past have had and continue to have major consequences for the habitat and species in and around rivers, streams, lakes, ponds and wetlands. Timber harvest activities not only affect the upper portions of the watersheds, where the majority of harvest is taking place, but they also have in-stream consequences far downstream.

There are numerous factors limiting the performance of fish stocks in King County that result from timber harvest. Timber harvest activities and some of their *potential* impacts to listed fish species and critical habitat include:

- Construction of logging roads and subsequent timber harvest in moderate to high gradient areas may result in:
  - Creation of juvenile and adult fish passage barriers, reducing accessible spawning and rearing habitat;
  - Erosion and subsequent sedimentation/aggradation downstream, thereby suffocating or entombing incubating eggs and hatched alevins, reducing the quality of downstream spawning habitat, and affecting downstream pools and diversity and abundance of aquatic macroinvertebrates (i.e. rearing potential);
  - Chronic turbidity in downstream reaches, affecting fish behavior and health (reduced foraging efficiency, growth and survival, gill trauma) or potentially killing fish at high turbidity levels;
  - These may be large-scale impacts when poor road construction on steep slopes initiates mass wasting, debris torrents, etc.;
- Widespread removal of the riparian vegetation may reduce bank stability, cover, shade, habitat for aquatic macroinvertebrates, LWD recruitment to the stream, and the channel complexity (pools, gravel accumulation, etc.) associated with this LWD, thereby affecting both spawning and rearing habitat;

- Removal of riparian vegetation may allow invasive plants (e.g. reed canary grass, blackberry, yellow iris) to establish and impair the natural functions and values of the riparian corridor and surrounding wetlands;
- Clear-cutting large portions of forested lands may alter the hydrologic cycle; with less water being absorbed by vegetation and released back to the atmosphere through evapotranspiration and more water contributing to surface-water runoff and associated downstream habitat problems (see urbanization section).

Some of the streams and rivers in the areas dominated by timber harvest are listed under Section 303(d) of the Clean Water Act as impaired for temperature exceedences and low dissolved oxygen levels (Table E-4). It is likely that exceedences documented at stations in or below areas with extensive timber harvest and above most other types of land-uses are caused primarily by timber harvest. Where timber harvest coexists with other land-uses described here, it is difficult to determine which land-use is responsible for the exceedences. Timber harvest without adequate riparian buffers may contribute to higher water temperatures and turbidity levels and lower dissolved oxygen content in streams.

Potential Impacts to Listed Bird Species and Critical Habitat

Timber harvest may *impact listed bird species* in King County by:

- Reducing the amount of nesting, perching and forage areas for all listed species in King County;
- Eliminating remaining old growth forests, or forests with and older tree components, thereby further reducing the nesting habitat for marbled murellets. Most of the old-growth habitat that existed in western Washington and King County is now gone, along with most of the suitable nesting habitat for this species;
- Increasing forest fragmentation - which may increase predation on marbled murellet nests by edge-associated predator species such as jays, crows, ravens and great horned owls (USFWS website No. 1);
- Reducing the amount of forests with adequate nesting and roosting habitat for the Northern spotted owl (e.g. moderate to high canopy closure, a multi-layered, multi-species canopy with large overstory trees; a high incidence of large trees with various deformities, large accumulations of fallen trees and other debris and sufficient open space below the canopy for the owls to fly (Thomas, et al. 1990, cited by USFWS Website No. 1)).

PROTECTED AREAS

Washington State protected areas: Kings Lake Bog Natural Area Preserve (309-acres); Snoqualmie Bog Natural Area Preserve (111-acres); Mount Si Natural Resource Conservation Area (NRCA; 8,000-acres); Rattlesnake Mountain Scenic Area NRCA (1,771-acres); West Tiger Mountain/Tradition Plateau NRCA (4,500-acres).

National protected area: Alpine Lakes Wilderness Area within the Mt. Baker-Snoqualmie National Forest (394,000 acres).

Outside of these protected areas, land-use activities are subject to national, state and local codes that also protect sensitive areas throughout King County (e.g. Northwest Forest Plan–USFS; Forest and Fish Plan–Washington State; King County Comprehensive Plan 2000). The acquisition of land by the County and other local governments for the protection of natural resources and the establishment of parks also serves to preserve sensitive areas within the County (e.g. King County Parks: O Grady Park, Moss Lake Natural Area, Soos Creek Park, Cougar Mountain Regional Wildland Park, etc.).

Information on Habitat Limiting Factors for Salmon in King County Water Resource Inventory Areas (WRIA):

WRIA 7 - *Snohomish Basin (Snoqualmie and upper Skykomish Rivers in King County)*

Nine high priority habitat problems were ranked from a list of 34 identified problems in the Snoqualmie River Basin by the Snohomish Basin Salmonid Recovery Technical Committee (Table E-2). Further details on limiting factors in this basin can be found in the "*Initial Snohomish River Basin Chinook Salmon Conservation/Recovery Technical Work Plan*" (Snohomish Basin Salmonid Recovery Technical Committee, 1999).

WRIA 8 - *Lake Washington Basin*

Detailed information regarding the current and future conditions and the basin plans for the Cedar River watershed are available (King County 1993, 1996). Similar information is available for the Bear Creek and Issaquah Creek basins (King County 1989, 1991). The Washington State Conservation Commission (WSCC) is currently working on a Habitat Limiting Factors Report for WRIA 8, which is expected to be complete by June 2000 (pers. comm., Kerwin, 2001). This WSCC report will rely heavily on information provided in the King County document "*A Reconnaissance Assessment of the Habitat Factors that Contribute to the Decline of Salmonids in the Greater Lake Washington Watershed*" (King County, 2001-in preparation). This King County document will describe the habitat factors contributing to the decline of salmonids for each sub-basin of this large WRIA. Limiting factors for this WRIA are likely to be similar to those described in WRIAs 7, 9 and 10, but with additional emphasis on the lake and canal systems as a rearing environment and migratory corridor for fish.

WRIA 9 - *Duwamish Basin (Green/Duwamish River)*

A summary of the habitat limiting factors in four sub-watersheds of the Green/Duwamish watershed (upper, middle, lower and estuary) and the Central Puget Sound Watersheds was completed by King County and the Washington State Conservation Commission. Further details on limiting factors in these watersheds can be found in the *"Habitat Limiting Factors and Reconnaissance Assessment Report"* (King County and WSCC, 2001).

WRIA 10 - *Puyallup Basin* (*only the White River is in King County*)

The Washington State Conservation Commission completed a summary of the habitat limiting factors in the White River Basin (Table E-3). Further details on habitat limiting factors in this watershed can be found in the "*Habitat Limiting Factors Report for the Puyallup-White River Basin (WRIA-10)"* (WSCC, 2000).

Watershed Descriptions:

Snoqualmie River Basin Description (WRIA 7)

Much of the information included in this section was compiled from the *"Initial Snohomish River Basin Chinook Salmon Conservation/Recovery Technical Work Plan*," (SBSRTC, 1999).

Geographic Description

The Snoqualmie River basin is one of the largest river systems in King County. It encompasses a drainage area of approximately 693 square miles and is approximately 84.5 miles in length, draining a portion of the north central Cascade Mountains east of the greater Seattle metropolitan area. Elevations range from 7400 feet (2265 meters) at the Cascade crest to an elevation of 20 feet (6 meters) at its confluence with the Skykomish River. The Snoqualmie River combines with the Skykomish River and forms the Snohomish River 20.5 river miles from its mouth at Puget Sound.

Mean daily flows in the Snoqualmie River (as measured at the USGS gage near the town of Carnation, below the confluence with the Tolt River) range from 1000 to 6700 cubic feet per second (c.f.s.). Because the upper reaches of the river drain the alpine and heavily snowed areas of the western Cascade mountains, the river experiences high flow events both in the spring, as a result of snowmelt, and in the fall/winter as a result of rainfall events.

The upper basin above Snoqualmie Falls has three major tributaries, the North, Middle, and South Forks of the Snoqualmie River. Moderate to steep channel gradients and relatively broad river channels characterize these tributaries. As the tributaries emerge from mountainous terrain and converge just upstream of the town of Snoqualmie, channel slopes begin to decline, as does the sediment-transport capability of the river. Slack-water conditions from geological and manmade features just above Snoqualmie Falls form an effective coarse-sediment trap for most of the material transported from the upper basin. Snoqualmie Falls, which drops 267-feet, is also an upstream fish-passage barrier.

Below Snoqualmie Falls, the water surface elevation drops only 100 feet (30 meters) in the forty river miles (65 kilometers) upstream of its confluence with the Skykomish River, with an average gradient of 0.046% (Booth, *et al.* 1991). The channel meanders widely through largely agricultural lands and a relatively broad, flat valley floor. This section of the river contains numerous pools and deep, slow moving glides, as well as many high-quality riffles (WDF 1975). Substrate and banks are largely composed of silts and fine sands. Coarser sediments are introduced at the confluences with the Tolt

River, Raging River and Tokul Creek at River Miles 24.9, 36.2 and 39.6, respectively (Booth, *et al.* 1991). These three rivers comprise the largest tributaries of the lower Snoqualmie River. Other major tributaries of the lower and middle Snoqualmie and their confluence points include Cherry Creek (river mile 6.7), Griffin Creek (river mile 27.2) and Patterson Creek (river mile 31.2). These six tributaries provide anadromous fish access to higher-gradient, smaller scale habitats as well as refuge from the main channel.

The South Fork of the Skykomish River, flows through King County and is a portion of this other major river system in WRIA 7. The South Fork's headwaters are in the northeast corner of King County and three of its four major tributaries, the Foss, Miller and Tye Rivers, are entirely within King County. The fourth major tributary, the Beckler River, has its headwaters in Snohomish County and flows south into King County before joining with the South Fork. These reaches are accessible to anadromous salmonids only by way of the trap-and-haul facility at Sunset Falls, a naturally occurring barrier near river mile 52.

The South Fork of the Skykomish flows generally west and northwest through a valley confined between steep, thickly forested and mountainous walls. Gradient in the upper basin is high, but the profile flattens out somewhat near the town of Skykomish (river mile 65-66) before increasing again with a series of steep falls as it leaves King County near river mile 54.

<u>Species Present</u>

Federally listed and proposed species that occur in these watersheds include the following. For species life histories and the factors to their decline, see Appendix B.

Fish:

- Puget Sound Chinook Salmon (*Oncorhynchus tshawytscha*) Threatened
- Native char (Bull Trout/Dolly Varden) Threatened

<u>Land Use Activities</u>

The upper basin above Snoqualmie Falls is host primarily to forest-related land uses. Seventy-four percent of the basin is comprised of private, state and federal forest lands and wilderness area. However, several growing towns have intensified rural and urban land-use practices in parts of the upper basin. Much of the watershed has been logged since the turn of the century, and little or no old-growth forest remains, except in preserve areas such as the Alpine Lakes Wilderness.

Below Snoqualmie Falls, the Snoqualmie basin experiences more diverse land-use, ranging from historical and current logging activities to suburban development, water supply withdrawals and flood control modifications. Three small but growing towns are situated along the Snoqualmie downstream of the Falls: Fall City at river mile 36, Carnation at river mile 24, and Duvall at river mile 10. Aside from the areas in and around these three towns, most of the Snoqualmie Valley floor is devoted to agricultural uses, including both crop production and livestock (including dairy). Low density residential development is increasingly common along the slopes adjacent to the valley and in the drainages that feed the Snoqualmie River.

The vast majority of the South Fork Skykomish's drainage basin is in the Mount Baker-Snoqualmie National Forest and is managed for timber production. The mainstem of the South Fork is paralleled by Highway 2 and the Burlington Northern Railroad line for most of its length. The small town of Skykomish and even smaller towns of Baring, Grotto and Miller River are situated along the river on the narrow valley floor.

Hydrological Processes and Modifications

A small dam structure located just above Snoqualmie Falls, combined with natural slack-water conditions prevents transport of course sediment from the upper basin to the lower basin. The Snoqualmie Falls hydroelectric facility itself is a run-of-the-river type, meaning its operation is governed by natural river flows and does not influence flows.

The South Fork Tolt River Dam and Reservoir were constructed in 1963 at river mile 7.8 by the City of Seattle for municipal and industrial water supply; a hydroelectric component was added in 1995. While the dam is a barrier to migration, a natural barrier is present downstream at river mile 6.8.

Bank Hardening, Diking and Dredging

Extensive reaches of the mainstem Snoqualmie have been diked or revetted for flood control, as well as reaches of the Tolt and Raging Rivers and the South fork of the Snoqualmie near North Bend. Construction and maintenance of infrastructure (e.g. roads, rail lines, utility crossings and bridges) have also contributed to pervasive bank armoring, channel straightening and pier placement within the rivers.

Gravel has historically been removed from several rivers in the basin to offset losses in channel capacity due to diking. Regular, large-scale dredging of the Raging and Tolt Rivers was halted in the 1960s. Dredging occurred in the South Fork Snoqualmie near the town of North Bend in the 1990s in response to flooding events there.

Water Quality

Water quality within the Snoqualmie and South Fork Skykomish basins is generally high. Low dissolved oxygen levels, high temperatures and chronic turbidity exist in some reaches and creeks, such as Marshlands, French, Quilceda, Allen and lower Patterson Creeks. A list of locations within WRIA 9 that exceed Section 303(d) criteria is included in Table E-4.

Fish Passage

There are no human-made barriers to fish migration on the mainstems of the Snoqualmie or Skykomish Rivers. Natural barriers occur on the Snoqualmie at Snoqualmie Falls (river mile 40.5), on the Tolt River at river mile 6.8 and on the South

Fork of the Skykomish River at Sunset Falls (river mile 51.5). Sunset Falls is surpassed by a trap-and-haul operation conducted by the Washington State Department of Fish and Wildlife. Numerous fish barriers are present on smaller tributaries of these systems in the form of floodgates where these tributaries flow through dikes to the mainstem and impassable culverts beneath both public and private roads (SBSRTC, 1999).

Lake Washington - Sammamish River - Cedar River Basin Description (WRIA 8)

<u>Geographic Description</u>

The Lake Washington – Sammamish – Cedar River Basin (WRIA 8) extends from Puget Sound eastward to the Cascade crest and from the headwaters of North Creek near the City of Everett south to the Cedar River headwaters southeast of the City of North Bend. The basin is 706 square miles in size and has a mean daily discharge of 1424 cubic feet per second (c.f.s.) (1/1/95 – 12/31/2000) at the Government Locks at Puget Sound. This drainage basin contains most of the Seattle-Bellevue metropolitan area and has experienced extensive anthropogenic modification over the last century. These changes include not only those wrought on the landscape by the building and growth of a large city and its suburbs, but also changes to the flow patterns of it's largest rivers and lakes. Prior to 1916, Lake Washington emptied at its south end via the Black River into the Green/Duwamish River and Elliott Bay. The Cedar River also flowed into the Black River just below the lake. In 1916, the ship canal was dredged from Lake Washington through to Lake Union and then to Puget Sound, where the Government Locks were constructed. Lake Washington's outlet to the Black River was sealed, the lake level was dropped approximately ten feet to that of Lake Union, and the Cedar River was diverted into Lake Washington to drain via the ship canal and Government Locks to Puget Sound.

Cedar River

The Cedar River is the largest and most productive tributary of the Lake Washington system. From its mouth at the south end of Lake Washington, within the City of Renton, the Cedar basin extends generally eastward to its headwaters at the Cascade crest. The basin drains 188 square miles. Most of the upper two thirds of the basin, known as the upper Cedar, is owned by the City of Seattle and managed to maintain high-quality drinking water. (An average of 191 c.f.s. is diverted for water supply by the Seattle Water Department.) While there is some logging activity in this area, it is pristine for the most part. However, the Landsburg diversion dam, approximately 22 miles upstream of Lake Washington, prevents anadromous fish use of the upper watershed.

The largest communities within the Cedar basin include the highly-urbanized City of Renton at the rivers' mouth (and the associated high-density residential developments east Renton's city limits) and the town of Maple Valley fifteen miles upriver. Much of the rest of the lower and middle basin is home to low-density residential development, including many homes within the river's floodplain. Numerous medium- to high-density subdivisions have also been built in the middle basin during the last ten years.

The middle Cedar basin, extending from the Landsburg diversion downstream to the town of Maple Valley, contains the highest quality, "anadromously-accessible" tributary habitat in the Cedar Basin. Rock Creek, Peterson Creek and Taylor Creek all support excellent spawning and rearing habitat for coho and sockeye salmon as well as trout. However, even these streams have shown signs of impact from development of their basins. Tributaries of the lower Cedar have experienced severe impacts resulting from high density development of their basins and several streams which used to support sizable anadromous fish runs, such as Madsen and Molasses Creeks, no longer do so.

Urbanization and development have also affected the mainstem of the Cedar. Most of the river bends between Renton and Maple Valley have been constrained by levees or revetments constructed to reduce flooding and/or prevent river channel migration. The mainstem also contains far fewer pools and much less LWD than would be optimal and has been substantially disconnected from its floodplain and riparian areas (King County, 1993). The lowermost reaches of the Cedar have been channelized and occasionally dredged by the U.S. Army Corps of Engineers (Corps) as it flows through downtown Renton.

The Cedar River has been managed by the Washington State Department of Fish and Wildlife (WDFW) for sockeye salmon production and hatchery brood stock since the 1930s. Sockeye from several different stocks were introduced into the system in the 1930s; the river had been unsuitable for sockeye prior to its diversion into Lake Washington because there were no lakes suitable for rearing in the system. Fish are collected at a temporary weir operated by the State near RM 6.5 until a quota of fish has been harvested.

Sammamish River

In addition to the Cedar River and numerous small tributaries draining the mostly urban areas adjacent to its shores, Lake Washington also receives flows from Lake Sammamish and the Bear and Issaquah Creek basins via the Sammamish River. The Sammamish River flows from the north end of Lake Sammamish northward, past its confluence with Bear Creek, and then westward into the north end of Lake Washington. The total length of the river is 13.8 miles and it has an average gradient of 0.01 percent. The Sammamish River has also experienced large-scale anthropogenic modification; first, the channel began to incise when Lake Washington was lowered in 1916 and then, in 1963/1964, the Corps implemented a flood control/channelization project on the river. This project straightened and channelized the low-gradient, meandering river, reducing its overall length by half. The channel is now largely straight, trapezoidal in cross section, lined with quarry spalls or rip-rap, and almost devoid of riparian trees. Commercial and agricultural development of the floodplain further reduced wetland and off-channel habitat.

Bear Creek

Bear Creek flows into the Sammamish River just downstream of its source at Lake Sammamish. Bear Creek drains approximately 51 square miles of land area. The mainstem has two major tributaries: Cottage Lake Creek and Evans Creek. Bear Creek hosts native stocks of sockeye (*Oncorhynchus nerka*), coho (*O. kisutch*) and chinook

(*O. tshawytscha*) and contains arguably the most valuable salmon spawning habitat in central Puget Sound (King County, 1989).

The Bear Creek basin extends to the northeast and southeast of its mouth near Redmond, Washington, draining the area east of the Sammamish River valley and west of the Snoqualmie River valley. Development in the basin is a mix of rural and suburban, though many of the rural areas are developing rapidly.

Issaquah Creek

Issaquah Creek and the North Fork of Issaquah Creek drain the areas to the south and southeast of Lake Sammamish (respectively) and both forks flow into the lake's southern end. The Issaquah basin encompasses 61 square miles (including Tibbets Creek and the North Fork, which both flow directly into Lake Sammamish) and includes the City of Issaquah, a rapidly growing suburb of the Seattle/Bellevue metropolitan area, as well as several small rural communities. The Issaquah Creek valley extends generally south from Lake Sammamish's southern tip and is bordered on the west by Cougar Mountain and on the east by Tiger Mountain and the Cascade foothills. The basin as a whole is of moderate gradient and is generally rural in character, but with encroaching suburban development.

Carey and Holder Creeks flow west and north from the predominantly forested areas of Taylor and Tiger Mountains to form the headwaters of Issaquah Creek. McDonald Creek joins the mainstem from the west, draining the more developed southern slopes of Cougar Mountain. From the McDonald Creek confluence, Issaquah Creek flows north through a U-shaped valley toward the rapidly growing City of Issaquah. The valley still has fairly large tracts of open space and undeveloped land, but also hosts large and ever-growing tracts of low and medium density residential development. The middle Issaquah basin contains a zone of relatively frequent channel migration, a natural process that is often lost with encroaching development.

The North Fork of Issaquah Creek originates in an area of dense residential development to the northeast of the City of Issaquah. This drainage also contains the most extensive and diverse wetlands in the Issaquah system, and these wetlands have experienced degradation due to upslope residential, commercial and mining development (King County, 1991). The North Fork flows generally southwest from its source toward the City of Issaquah, then turns to the northwest as it enters the city and flows toward its mouth at Lake Sammamish.

The mainstem of Issaquah Creek flows through the center of the City of Issaquah, where it has been channelized and its riparian areas developed. The Issaquah State Fish Hatchery is also within the City of Issaquah.

The mouths of Issaquah Creek, its North fork, and Tibbets Creek are all within Sammamish State Park, which contains much of the shoreline of the southern tip of Lake Sammamish.

Species Present

Federally listed and proposed species that occur in these watersheds include the following. For species life histories and the factors to their decline, see Appendix B.

Fish:

- Puget Sound Chinook Salmon (*Oncorhynchus tshawytscha*) Threatened
- Native char (Bull Trout/Dolly Varden) (Possibly) Threatened

Land Use Activities

The Lake Washington Basin contains most of metropolitan Seattle and many of its suburbs, including Bellevue, Redmond, Issaquah, Woodinville, Renton and others. Lakes Washington and Sammamish are virtually surrounded by medium- to high-density residential development and Lake Union and the Ship Canal are lined with commercial and industrial development. Yet, the upper watersheds of most of the major sub-basins are still forested, for the most part. The upper Cedar River watershed is managed for municipal water supply by the City of Seattle and is almost entirely undeveloped. Large tracts of forested land also surround the upper reaches of Issaquah Creek and its headwater tributaries, Carey and Holder Creeks. The upper Bear Creek watershed, while facing increasing residential development pressure, remains relatively well buffered and contains significant forested tracts. However, each of these major tributaries of the Lake Washington Basin flows through a highly developed urban area in its lower reaches before emptying into one of the larger lakes or the Sammamish River. The Sammamish River itself flows through the cities of Redmond and Woodinville, but also through agricultural lands on its course from Lake Sammamish to Lake Washington.

Hydrological Processes and Modifications

As mentioned above, the Lake Washington drainage has experienced extensive anthropogenic modification over the last century. In 1916, the Cedar River was diverted from its original course, which took it into the Green/Duwamish River via the Black River, into Lake Washington. Both the Cedar River and Lake Washington, which also previously discharged to the Black and Green/Duwamish, were diverted through the newly constructed Montlake Cut and Ship Canal to Lake Union and Puget Sound at Shilshole Bay. The elevation of Lake Washington was dropped by approximately 12 feet in the process and this level is controlled by the Hiram M. Chittenden Locks (also known as the Government Locks).

In 1962, the Corps constructed a large-scale channelization project on the Sammamish River, which connects Lakes Sammamish and Washington. The low-gradient, sinuous channel was straightened and regraded to a trapezoidal profile, reducing its overall length by approximately fifty percent. This action also severed the river's connection with its floodplain and eliminated all off-channel habitat. The Sammamish was also affected by the lowering of Lake Washington in 1916, which caused the Sammamish's channel to downcut.

The City of Seattle Water Department (SWD) operates the Overflow Dike, Masonry Dam and Landsburg Diversion Dam as components of its water supply system on the Cedar River. These dams are located at river miles 37.2, 35.6 and 21.6, respectively. On average, the SWD withdraws approximately 190 c.f.s. for municipal water supply from the Landsburg Diversion. In addition to these modifications to the upper Cedar Watershed, discharge from Walsh Lake, which naturally discharges to the north into the Issaquah Creek Watershed, was diverted via the Walsh Lake Diversion Ditch to discharge to the Cedar basin in the 1920s. The Walsh Lake Diversion ditch, which supports runs of Sockeye and Coho salmon, joins the Cedar River near river mile 19.6.

Bank Hardening, Diking and Dredging

Extensive portions of the banks of the middle and lower reaches of the Cedar River have been diked or revetted as parts of flood control efforts. This has resulted in disconnection of the mainstem from its floodplain and many of its natural side channels. Issaquah creek has also been diked and revetted in it's lower reaches, where it flows through the City of Issaquah, and in isolated segments of its upper and middle reaches. Likewise, the banks of Bear Creek have been hardened only in isolated segments. However, almost the entire channel of the Sammamish River, with the exception of its uppermost and lowermost reaches, has been graded to a uniform slope and armored with rock. The Sammamish has been completely isolated from its floodplain and has virtually no remaining side channel habitat.

Water Quality

Water quality in the Lake Washington drainage ranges from the nearly pristine, in the upper basin(s), to various levels of degradation in Lake Union, along the Ship Canal and in the Sammamish River. Lake Union and the Ship Canal are used for industrial purposes and therefore subject to not only present point and non-point sources of contamination, but also to a long history of contamination stored in their sediments. Lake Sammamish has phosphorus loading problems and many places within the basin have exceeded standards for fecal coliform levels. The Sammamish River has fairly severe temperature problems, due primarily to the fact that it receives it's flows from the top layers of Lake Sammamish. A full list of Section 303(d)listings for the basin is included as Table E-4.

Fish Passage

All migration in and out of the Lake Washington basin must pass the Hiram Chittenden (Government) Locks, operated by the Corps. The locks are fish passable via a fish ladder, however, they present several problems to migrating fish. First, fish passing from salt water below the locks to fresh water above face an abrupt transition from cool salt water to warm freshwater without the buffering effects of a natural estuary. Also, fish are delayed below the locks where they face predation from sea lions. Although improvements have been made in recent years, smolts passing through the bypass culverts at the locks are subject to descaling, disorientation and subsequent predation by birds (Goetz, 2000).

The Landsburg Diversion dam at river mile 21.6 on the Cedar River is impassable to upstream-migrating fish. This barrier is maintained by the City of Seattle Water Department due to concerns over decaying fish mingling with the municipal water supply. This barrier prevents the entire upper Cedar River watershed from utilization by anadromous fish.

Central Puget Sound

The Central Puget Sound Basin extends from the mouth of the Ship Canal (see Lake Washington Watershed description) north to the King-Snohomish County line and contains the twenty independent short-run tributaries that drain directly to Puget Sound. Administratively, this area is often included in WRIA 8 (Lake Washington Drainage) but is treated separately here due to the different character of its streams and drainages.

Only two of the twenty streams contained in this drainage area, Pipers Creek and Boeing (Hidden Lake) Creek, are accessible to anadromous fish and these each measure only 1.35 miles in length (WDF 1975). The drainage basins of these two streams, as well as the rest of the Central Puget Sound basin, is covered with medium- to high-density residential development as well as areas of industrial/urban development. However, both Pipers Creek and Boeing Creek have park areas bordering at least portions of their lengths. A railroad grade runs along virtually the entire coastline of this basin. The railroad grade either fills or severely alters the flow patterns of the estuarine zones of these streams.

Green/Duwamish Basin Description (WRIA 9)

Much of the information in this section was gathered from *“Habitat Limiting Factors and Reconnaissance Assessment Report, Green/Duwamish and Central Puget Sound Watersheds (WRIA 9 and Vashon Island)*” (Kerwin and Nelson, 2000).

Geographic Description

The Green/Duwamish River (WRIA 9) is a 6th-order, 91-mile long stream that originates in the Cascade Mountains nearly 30 miles northeast of Mount Rainier and flows into Puget Sound at Elliott Bay in Seattle. The Green River basin comprises 568 square miles and is bounded on the north by the Cedar-Sammamish watershed (WRIA 8), and to the south by the Puyallup watershed (WRIA 10). The mean annual flow in the lower Green River (measured at the Auburn gage) is 1,350 cfs, the average historic minimum flow prior to construction of Howard Hanson Dam (HHD) was approximately 140 cfs, and the maximum historic recorded flows is 28,000 to 30,000 cfs. Since construction of HHD, the average minimum flow is 210 cfs, and the maximum recorded flow was approximately 11,500 cfs.

The climate in the Green River watershed is generally mild, with wet winters and dry, cool summers. Annual precipitation varies widely, ranging from over 100 inches in the Cascade foothills and decreasing westward to 35 inches in Seattle. The human population in the Green/Duwamish watershed, estimated to be 564,900 in the mid-1990s, is mostly concentrated within the lower (west) end of the watershed, but the fastest rate of population increase is in the suburban cities and nearby unincorporated areas east of Seattle (King County 1995).

The basin can be divided into five physiogeographic parts: the headwaters (headwaters to HHD at RM 64.5); the upper Green River, including the Flaming Geyser gorge (HHD to Flaming Geyser State Park at RM 46.4); the middle Green River (Flaming Geyser State Park to the Soos Creek confluence at RM 33.8); the lower Green River (Soos Creek confluence to the Black River confluence at RM 11.1); and the estuary, a.k.a. the Duwamish River, from the Black River confluence to the mouth at Elliott Bay (RM 0.0).

Headwaters: From the vicinity of Blowout Mountain and Snowshoe Butte, the river flows generally west and northwest for approximately 25 miles through a narrow valley and steeply sloped, densely forested terrain, gathering flows from Sunday, Sawmill, Champion, Smay and Charlie Creeks, as well as from the North Fork Green River. Tacoma Public Utilities (TPU) operates a well field in the North Fork Green River drainage above HHD. The well field, developed in 1977, consists of seven wells, which can be used to withdraw water from an unconfined aquifer at depths ranging from 65 to 103 feet. This water is used to replace or supplement surface water withdrawn from the Green River at TPU's RM 61.5 water supply headworks. When the turbidity of Green River surface water approaches five NTUs, the North Fork well field provides a source of clean groundwater that allows TPU to provide the public with water that meets federal and state water quality standards. In general, pumping from the North Fork well field occurs during the late fall, winter and spring when turbidity increases as a result of storm events and resultant high streamflow. These events sometimes triggers landsliding and/or mass wasting in the heavily logged upper Green River watershed and erosion of the HHD reservoir shoreline.

Upper Green River: Immediately below the North Fork confluence at approximately RM 64.5 is HHD, which the Corps constructed in 1961 as a flood control facility. The reservoir behind the dam currently provides up to 106,000 acre-feet of storage at elevation 1,206 feet. Water stored behind HHD during the summer is used to provide downstream low flow augmentation, and plans are underway to expand the summer conservation pool storage capacity to further augment summer low flows and provide occasional releases in the spring that would simulate natural freshets in the spring and early summer. No upstream or downstream fish passage facilities were included in the original HHD project because of the fish passage blockage 3.3 miles downstream at the TPU headworks.

At approximately RM 61.0, TPU maintains municipal water supply diversion facilities that have blocked anadromous fish migration since construction of this facility in 1913. Volunteers from Trout Unlimited capture and truck adult salmon and steelhead upstream from this passage barrier for release above HHD. As mentioned above, TPU and the Corps are currently proposing to store 5,000 acre-feet of water during drought years to provide additional water for downstream low flow augmentation.

Below TPU's diversion, the river flows between narrow, steeply sloped valley walls through mostly forested mountain terrain before emerging from the mouth of the gorge at approximately RM 46.4 at the upstream end of Flaming Geyser State Park.

Middle Green River: From upper Flaming Geyser State Park, the river flows through a broad, gently sloped valley with mostly agricultural land uses. In contrast with upstream areas, extensive portions of this reach are affected by levees and revetments that constrain channel migration while not necessarily containing floodwaters. Within Flaming Geyser State Park (RM 43.3 to 45.0), Metzler/O'Grady Park (RM 38.9 to 39.6) and Auburn Narrows Parks (RM 32.6 to 33.7) the river is largely bordered by forested land and is less subject to bank armoring. As a result, these areas exhibit more natural riverine and riparian habitat characteristics.

Lower Green River: Downstream from King County's Auburn Narrows Park at RM 32.6, the river enters increasingly urbanized areas within the cities of Auburn, Kent and Tukwila, where, except for occasional stretches of riparian park land, the river is bordered by a densely developed mixture of residential, commercial and industrial land uses. The entire Lower Green River mainstem is in a highly degraded condition, with overall poor habitat quality. Habitat degradation in this reach began in the mid- to late-19th century, when early Euro-American settlers converted the valley floor to agricultural land uses. With continuing development in the Green River Valley during the mid- to late-20th century, incremental channelization and bank hardening efforts were carried out, culminating in the 1960s and 1970s when the present extent of channel simplification and bank hardening was completed. As a result of decades of these landscape modifications, most of the remaining remnant side channels and tributaries are now disconnected from the active floodplain, and few pieces of LWD remain in the stream.

Other causes of habitat degradation within this reach include: aggressive removal of the enormous volumes of LWD that filled the historic channel and off-channel aquatic habitats within the floodplain; construction of roads, bridges, drainage systems and other urban infrastructure; inputs of nonpoint pollutants from agricultural sources and urban stormwater; wholesale removal of riparian vegetation from the riverbanks and subsequent replacement with narrow strips of invasive non-native species (primarily blackberries and reed-canary grass); and filling and development of much of the historic floodplain for agricultural, residential and commercial land uses.

Estuary: Downstream from the Black River confluence (RM 11.1), which is also considered the upstream limit of tidal influence, the Green River continues as the Duwamish River, which flows past scores of industrial and commercial facilities, as well as scattered urban parks and single- and multi-family residences. The Duwamish River and Elliott Bay have been extensively modified over the last 100 years, including the filling of 99 percent of the original wetlands (riparian swamps, high and low salt marshes, unvegetated tideflats and gravelly beaches), and shallow subtidal habitats (eelgrass and kelp beds). These habitats have also been adversely affected by extensive river channelization and dredging (Bortelson et al. 1980). As noted by Thom et al. (1994), such modifications can cause an array of ecological effects, including short-term construction impacts, direct burial or displacement of riparian and nearshore habitats, and indirect impacts on habitat via disruption of riverine and littoral sediment supply. Substantial sediment contamination and water quality problems have also been documented in the Duwamish River and Elliott Bay, the receiving embayment of Puget Sound (Ecology, 1998).

Species Present

Federally listed and proposed species that occur in these watersheds include the following. For species life histories and the factors to their decline, see Appendix B.

Fish:

- Puget Sound Chinook Salmon (*Oncorhynchus tshawytscha*) Threatened
- Native char (Bull Trout/Dolly Varden) (Possibly) Threatened

Land Use Activities

The upper watershed of the Green River is used almost entirely for commercial forestry. Other land uses include the reservoir behind HHD, the Burlington Northern Santa Fe Railroad line and a major electric utility transmission line.

The middle Green River basin is roughly split between residential development (50%) and a mix of commercial forestry (27%) and agriculture (12%). Twenty-two percent of the middle Green River basin is within King County's designated Urban Growth Area (UGA).

The lower Green River basin is almost entirely within King County's UGA (which includes 30% of the entire Green River basin). Most of this area is incorporated into several suburban cities (Algona, Auburn, Federal Way, Kent, Renton, SeaTac, and Tukwila). It is estimated that 80% of the Green River from between river miles 17 and 33 has been leveed or revetted on at least one bank for flood protection (Perkins, 1993) and most of the flood plain has been filled, drained and developed.

The Green/Duwamish estuary lies at the center of the most heavily industrialized area in Washington. The lower river is used for industrial purposes including commercial shipping. Ninety-seven percent of the estuary has been filled (USACE, 1997). Approximately 43% of the estuarine sub-watershed is characterized by industrial development and 39% by residential development.

Hydrological Processes and Modifications

Howard Hansen Dam at river mile 64.5 and the TPU diversion just downstream at river mile 61 have significantly modified the hydrologic processes of the middle and lower Green River. The dam, in addition to posing and impassable fish barrier (as does the TPU diversion below it), prevents the transport of both large woody debris and sediments/gravel to the middle and lower reaches of the river. Those reaches are therefore deprived of the natural sources for these elements and the characteristics they provide. Winter flows released from HHD are sufficient to transport coarse sediment downstream, thus material stored in the channel downstream of the dam is transported further downstream without being replenished by upstream sources. This has resulted in a loss of spawning gravels and formation of an armor layer on the channel bed in reaches immediately downstream of the dam and these characteristics are progressing downstream.

Early in the 20^{th} century, large-scale modifications were performed on the lower reaches of the Green River. The White River flowed into the Green at approximately river mile 32 prior to large floods in the year 1906. During the flood, the White changed course to flow into the Puyallup River to the south. In 1915, A flood wall was built to prevent the White from changing courses back to the Green.

In 1916, the Cedar River was diverted above its confluence with the Green to flow into Lake Washington and out through the Government Locks. This action, combined with the diversion of the White River, deprived the lower Green River and its estuary of approximately two-thirds of its fresh water supply (Kerwin and Nelson, 2000).

Bank Hardening, Diking and Dredging

Extensive portions of the banks of the middle, lower and estuarine reaches of the Green River have been diked, revetted, armored and/or channelized primarily for flood control. This has resulted in dramatic decreases in the amount of side channels and active gravel bars and in the general complexity of available habitat

Water Quality

Water quality within the Green River Watershed is closely linked with the level of urbanization/development. The upper watershed, above HHD, is mostly forested and exhibits fairly high water quality. The middle Green sub-basin is primarily agricultural and residential in character and still exhibits fairly high water quality. The lower Green and Duwamish sub-basins, however, have been degraded by their proximity to industrial and highly urban land uses. A list of locations within WRIA 9 that exceed Section 303(d) criteria is included in Table E-4.

Fish Passage

Construction of TPU's headworks and HHD together have resulted in the loss of anadromous fish access to 29.8 miles of mainstem and 6.9 miles of side channel habitats, as well as 66.8 miles of tributary and 3.3 miles of tributary side channels. In addition to loss of access, the HHD reservoir inundates several miles of mainstem and tributary habitat, converting it from high quality spawning and rearing habitat to less valuable rearing and migratory corridor habitats. A temporary adult fish trap is currently operated on the right bank at the headworks. This trap is used to capture adult steelhead for transport upstream of HHD and artificial propagation. At present, adult chinook and coho salmon are not trucked above the dam, but juveniles are outplanted in the upper watershed. Outmigration of juvenile salmonids of all species is currently impaired by the design of the dam, which provides egress through an opening in the dam located approximately 150 feet below the spillway surface. In the relatively slack water conditions within the reservoir it is extremely difficult for salmonid fry and even yearlings to find this orifice, let alone survive after passing through it. Tacoma Public Utilities has installed temporary screens downstream of the headworks trashrack in an effort to reduce the entry of juvenile salmonids into the water supply system. Currently these screens do not meet criteria established by WDFW. Many elements of these fish passage facilities are proposed to be modified to correct fish passage and survival problems in TPU's draft habitat conservation plan (HCP) (Tom Nelson, Pers. Comm. December 1999).

In addition to these mainstem barriers, numerous tributaries suffer from impassable road culverts under both public roadways and private logging roads (Kerwin and Nelson, 2000).

Lower Puget Sound

The Lower Puget Sound basin extends from the mouth of the Duwamish River south to the King-Pierce County line and contains all of those areas which drain directly to Puget Sound, rather than to the Green/Duwamish system. Administratively, this area is often grouped into WRIA 9 (Green/ Duwamish), but is treated separately here due to the different character of its streams. Most of this coastline dominated by high bluffs and the basin contains, either partially or entirely, the cities of Federal Way, Des Moines, Normandy Park, SeaTac and West Seattle. Approximately 15 streams enter Puget Sound within this section and all receive most of their flow from springs, lake outlets, rain and groundwater runoff (WDF 1975). The largest and longest of these creeks are Miller Creek, at 4.8 miles in length, and Des Moines Creek, at 3.45 miles in length.

Both Miller and Des Moines Creeks, like virtually all of the other creeks in this basin, have undergone extensive alteration and deterioration as a result of intense urbanization and residential development. Estuarine areas for almost all of the creeks have been filled and channelized. Their flow regimes have been altered by extensive impervious surfaces within their drainages and obstacles such as impassable culverts and weirs are present.

White River Watershed Overview (WRIA 10)

Geographic Description

Much of the information in this section was gathered from *the Washington State Conservation commission's Salmon and Steelhead Habitat Limiting Factors Report for the Puyallup River Basin (WRIA 10)* (Kerwin, 1999).

The White River flows northward from Mount Rainier, and then westward through the Cascade foothills and Puget Sound lowlands to its confluence with the Puyallup river and then into Commencement Bay, adjacent to downtown Tacoma. The middle and lower reaches of the White form the political boundary between King County to the north and Pierce County to the south. The Greenwater River, one of the White's major tributaries, forms that same boundary upstream (east) of their confluence. While the majority of the White's watershed lies outside of King County, this section will, for the most part, address conditions existing throughout the entire drainage.

The mainstem of the White River is approximately 68 miles in length and drains a basin of approximately 494 square miles. The annual mean streamflow as measured at the gage near Buckley is between 773 and 1,168 cubic feet per second (c.f.s.). Its headwaters drain the Emmons and Fryingpan Glaciers on the northeast slopes of Mount Rainier. The uppermost 16 miles of the mainstem are within Mount Rainier National Park , as are the upper reaches of Huckleberry Creek and the White's West Fork. The mainstem of the White flows generally northward, passing out of the Park and into Pierce County, and picking up it's two major headwater tributaries—Huckleberry Creek and the West Fork—before its confluence with the Greenwater River near River Mile 46.

The Greenwater flows into the White from the southeast and drains managed forest lands that have experienced extensive impacts from timber harvest (WDF 1975). From here, the White flows westward and is joined by the Clearwater River from the south before flowing into Mud Mountain Reservoir and Dam. Mud Mountain dam, located at River Mile 29.6 is impassable to upstream-migrating fish, as is the Lake Tapps Diversion dam located just downstream at River Mile 24.3. Migrating fish have access to the upper reaches of the White River Basin via a trap-and-haul operation that collects fish at the Lake Tapps Diversion and releases them upstream of Mud Mountain Reservoir at River Mile 33.9.

While the reaches above Mud Mountain Dam are primarily forested and/or managed for timber harvest, the reaches below these dams flow across the Puget Lowlands and pass the towns of Enum Claw, Buckley, Auburn and Sumner, where the White joins the Puyallup River. This lower reach of the White flows through areas of agricultural and, increasing residential and urban development. Prior to a large flooding event in 1906, the majority of the White's flow entered the Green-Duwamish River system; however, a debris dam deposited by the flood diverted the entire flow into the Stuck River channel and to the Puyallup River to the south, abandoning the original channel. A permanent diversion wall was constructed near Auburn in 1915 and the White has since remained a tributary of the Puyallup.

<u>Species Present</u>

Federally listed and proposed species that occur in these watersheds include the following. For species life histories and the factors to their decline, see Appendix B.

Fish:
- Puget Sound Chinook Salmon (*Oncorhynchus tshawytscha*) Threatened
- Coastal/Puget Sound Bull Trout (*Salvelinus confluentus*) Threatened

<u>Land Use Activities</u>

The upper reaches of the White River and it's largest headwater tributaries, the West Fork and Huckleberry Creek, are within Mount Rainier National Park and therefore are protected from timber harvest and other development activities. However, the middle reaches of the White, between the Park boundary at River Mile 62.5 and the Lake Tapps Diversion at River Mile 24.3 flows through Mt. Baker-Snoqualmie National Forest. Many of the sub-basins within these reaches have been logged extensively.

Below the dams, basin land use is a combination of agricultural, residential and commercial with densities increasing as the river approaches its confluence with the Puyallup. Permitted sewage outfalls enter the river from the towns of Enumclaw and Buckley.

Hydrological Processes and Modifications

The Mud Mountian Dam and Lake Tapps Diversion Dam not only affect fish passage but they also interrupt the natural hydrological and fluvial processes. The upper, higher gradient reaches of the White flow through a series of glacial and mudflow deposits and transport a tremendous sediment load. Much of this sediment is trapped in Mud Mountain Reservoir, depriving the lower reaches of a natural source of sediments and fine gravels. This, combined with direct removal of gravels from the channel bed as a part of flood control efforts, has resulted in a simplified channel lined with unnaturally large substrate through the lower reaches that is generally unsuitable for salmonid spawning. Mud Mountain Dam also interrupts the transport of large woody debris from the forested upper reaches to the primarily developed lower reaches, depriving those reaches of yet another form of structure.

Diversion of flows into Lake Tapps via the Lake Tapps Diversion Dam for the purpose of power generation has resulted in decreased summer flows through the bypassed reach (River Miles 23.4 to 3.5). Maintenance of minimum flows through this reach, currently required to meet 130 c.f.s., remains a subject of disagreement between the various concerned parties and agencies.

The diversion outfall, where diverted water flows back into the White River at the Dierenger Powerhouse (River Mile 3.5) has also caused problems for migrating salmonids. High velocity flows attract migrating salmon into the discharge channel, causing delays in migration, expenditure of energy and potential injury (Muckleshoot Indian Tribe, 1996). Operation of the powerhouse also causes rapid changes in river levels that strand both adult and juvenile fish and expose them to predation.

Bank Hardening, Diking and Dredging

The lowermost 8.5 miles of the White River upstream of its confluence with the Puyallup are channelized between levees along both banks. These levees impair movement of fish to tributaries and off-channel refuge areas. Smaller flood control structures exist along both the White and Greenwater Rivers near their confluence and the town of Greenwater. Highway 410 also encroaches into the active channel in places and forms a hardened bank that requires occasional maintenance and reconstruction. Gravel removal and dredging have occurred in the lower reaches of the White in attempts to provide flood control.

Water Quality

While water quality in the White River is generally regarded as being high, the Section 303(d) 2000 list shows the White River exceeding thresholds for fecal coliform (two locations), pH (three locations), temperature (three locations), instream flow (two locations), copper (one location) and mercury (one location). Three locations on the Greenwater exceed temperature thresholds, as does one location on Boise Creek and another on Scatter Creek. (See Table E-4 for complete list.)

Fecal coliform levels exceed thresholds near the towns of Buckley and Enumclaw, where treated sewage effluent is discharged to the river, and also adjacent to the town of Sumner.

Fish Passage

The Mud Mountain Dam at River Mile 29.6 and the Lake Tapps Diversion Dam at River Mile 24.3 form complete barriers to upstream migration of fish. These barriers are somewhat mitigated by the Corps' trap-and-haul operation which traps fish at the Lake Tapps Diversion and trucks them upstream past the Mud Mountain Reservoir to River Mile 33.9. However, it is likely that this causes delays in fish migration and additional stress through handling, hauling and release. Many trapped fish also exhibit injuries that may be sustained either in the trapping operation or at the tailrace outlet canal at Dierenger powerhouse (Kerwin, 1999).

Low minimum flows in the reaches bypassed by the Lake Tapps diversion have also posed passage problems for upstream migrating adults during dry years.

In addition to these mainstem barriers, numerous tributaries suffer from impassable road culverts under both public roadways (notably State Highway 410) and private logging roads. Table E-5 below shows a list of White River tributaries identified in the Salmon Habitat Limiting Factors Report for the Puyallup River Basin as having fish passage problems (Kerwin 1999).

Table E-1: Listed species not included in the Species List for restoration projects within King County with reasoning for exclusion from list:

Gray wolf

<u>Species and habitat distribution with respect to project areas.</u>

The gray wolf was listed as endangered in 1978. Recent observations indicate that wolves exist in Washington, likely in small numbers, and mostly as individuals. The probable range of gray wolves in Washington is in the Cascade Mountains and in northeastern Washington. Gray wolves tend to focus on areas that are free from human disturbance and harassment, have low road densities and which support large numbers of prey species (deer, elk, goat, moose and beaver (Stevens and Lofts 1988).

There is a scarcity of information on distribution and population size for gray wolf in the King County area. There have been recent (within 10 years) reports of gray wolf sightings in the North Bend/Preston area. There may be suitable habitat for this species in the rural service area in the cascades where human disturbance from logging and other land-use activities has been minimal, but it is unlikely that there is any suitable wolf habitat within the urban service area. It is unlikely that the SWP's construction projects will take place near or within suitable gray wolf habitat. Most habitat restoration projects will be at lower elevations and in areas with relatively recent (within 50 yr.) land-use activities (high road density; and few, if any, projects will be implemented in the Forest Production or Wilderness Zones within the rural service area. Therefore, project effects on the gray wolf will not be documented unless the project manager or Service staff determine that the project is in an area where: (1) there has been a recent sighting; (2) there is reason to believe that significant, suitable habitat exists; and (3) construction will severely affect this species or its habitat.

Canada Lynx

<u>Species and habitat distribution with respect to project areas.</u>

The Canada lynx was listed as threatened on March 4, 2000. The Cascade mountain range of Washington is considered part of this species' historic range (McCord and Cardoza 1982, Quinn and Parker 1987). Current lynx populations in Washington are estimated between 96 and 191 individuals (WDFW 1993). Canada lynx occur primarily in boreal forests throughout their range and require late-successional forests that contain cover for kittens (especially deadfalls) and for denning (Koehler and Britell 1990). In Washington and other states near the southern end of their range, Canada lynx are typically found at high elevations.

There is a scarcity of information on distribution and population size for Canada lynx in the King County area. There is no suitable lynx habitat within the urban service area.

There have been no documented sightings of Canada lynx west of the summit in King County (G. Koehler-WDFW, pers. comm August 15, 2000). There may be suitable habitat for this species in the rural service area at high elevations of the cascades where human disturbance from logging and other land-use activities has been minimal. However, it is unlikely that any of the SWP's construction projects will take place near or within suitable lynx habitat. Most habitat restoration projects will be at lower elevations and in areas with relatively recent (within 50 yr.) land-use activities; and few, if any, projects will be implemented in the Forest Production or Wilderness Zones within the rural service area. Therefore, project effects on the Canada lynx will not be documented unless the project manager or Service staff determine that the project is in an area where: (1) there has been a recent sighting; (2) there is reason to believe that significant, suitable habitat exists; and (3) construction will severely affect this species or its habitat.

Grizzly Bear

<u>Species and habitat distribution with respect to project areas.</u>

The Northern Cascades has been identified as one of the six important ecosystems in the grizzly bear recovery plan (USFWS 1993a). Almack et al. 1994 estimated the 1991 grizzly bear population in the Northern Cascades recovery area at less than 50 and perhaps as low as 5 to 20. In the King County area, there has been at least one confirmed sighting of a grizzly bear (and cub) in the Alpine Wilderness area (Stenberg pers comm.). There have been no reports of grizzly bear sightings within the urban service area.

As with the Canada lynx and the gray wolf, there may be suitable habitat for this species in the cascades (rural service area) where human disturbance from logging and other land-use activities has been minimal. However, it is unlikely that SWP's construction projects will be near or within suitable grizzly bear habitat. Most habitat restoration projects will be at lower elevations and in areas with relatively recent (within 50 yr.) land-use activity (i.e. high road density, disturbance etc.). Few, if any, projects will be implemented in the Forest Production or Wilderness Zones – those areas most likely to contain suitable habitat for grizzly bears. Therefore, project effects on the grizzly bear will not be documented unless the project manager or Service staff determine that the project is in an area where: (1) there has been a recent sighting; (2) there is reason to believe that significant, suitable habitat exists; and (3) construction will severely affect this species or its habitat.

Water howellia

<u>Species and habitat distribution with respect to project areas.</u>

Water howellia was listed as a threatened species in June 1994. Populations of water howellia have recently been found in several vernal, freshwater wetlands in Pierce, Thurston and Clark counties where there is an annual drop in water level of at least one foot (T. Thomas pers. comm., August 11, 2000). Water howellia is incapable of germinating under water, thus it can only complete its lifecycle in intermittent aquatic habitats (Lesica 1992). This species has not yet been found in King County, but there are wetlands in the rural service area that may satisfy its habitat requirements. Therefore, project effects on this species will not be documented unless the project manager or Service staff determine that the project is in an area where: (1) recent surveys have shown its presence ; (2) there is reason to believe significant, suitable habitat exists; and (3) construction will severely affect this species or its habitat.

Golden paintbrush

Species and habitat distribution with respect to project areas.

Golden paintbrush was listed as a threatened species in June 1997. Historically, this species was reported from over 30 sites in the Puget Trough of Washington and British Columbia. Typically it was found in upland-prairie, grassland habitats in areas such as Whidbey Island. Alki point was the only documented location where golden paintbrush existed in King County (T. Thomas pers. comm., August 11, 2000). In 1984, an assessment of the species found that it was extirpated from more than 20 historic sites (Sheehan and Sprague 1984; Gamon 1995b). Due to the intense development of Alki point, it is unlikely that this population still exists. It is very unlikely that the SWP's projects will be implemented in areas where suitable habitat exists for golden paintbrush. Therefore, project effects on this species will not be documented unless the project manager or Service staff determine that the project is in an area where: (1) recent surveys have shown its presence; (2) there is reason to believe significant, suitable habitat exists; and (3) construction will severely affect this species or its habitat.

Table E-2 - WRIA 7 - Snohomish Basin - Key Findings

Excerpt from: Snohomish Basin Salmonid Recovery Technical Committee. 1999. *Initial Snohomish River Basin Chinook Salmon Conservation/Recovery Technical Work Plan*. 135pp.

The Technical Committee identified 34 problem statements that may contribute to the decline of chinook salmon populations in the Snohomish River Basin. The **first nine problems** were identified as the most important, and they are addressed in the main document.

1. Loss of channel area and complexity due to bank protection and diking of the river and major tributaries, cutting off the channel from its floodplain.

2. Dearth of in-channel large woody debris.

3. Flood flows that scour redds at high frequencies.

4. Increased sediment input to streams as a result of slope failures.

5. Poor quality riparian forests.

6. Loss of wetlands due to draining for land conversion that eliminates habitat and reduces water retention.

7. In redd mortality due to siltation or water quality contamination.

8. Urbanization (road construction, commercial and residential construction, additional bank hardening) that further reduces chinook salmon viability in the basin.

9. Artificial barriers (dams, tide gates, diversions, culverts, pump stations) that prevent juveniles from reaching rearing habitat.

10. Reduced availability and use of spawning gravel in the summer due to low flows.

11. Artificial barriers (dams, tide gates, diversions, pump stations, etc.) prevent adults from reaching spawning habitat.

12. Artificial barriers (dams, tide gates, diversions, pump stations, etc.) inhibit juvenile migration to the estuary.

13. Poor connectivity of habitat leads to high rates of predation/mortality in migrating juveniles and/or adults.

14. Shoreline alterations (bulkheads, piers, fill, etc.) in the estuary disrupt key salt water habitat.

15. Water quality contamination renders habitat useless to fish.

16. Water quality contamination causes fish mortality.
17. Water temperature problems reduce summer rearing habitat and delay upstream migration of spawners.
18. Gravel mining disrupts substrate transport and deposition patterns, resulting in redd scouring and reduced egg to emergent survival.
19. Excessive human activity in riparian areas (camping, fishing, boating) tramples vegetation, contaminates water and disturbs fish behavior.
20. Excessive livestock access to riparian areas leads to loss of vegetation, water contamination, disruption of fish behavior, and damage to redds.
21. Water withdrawals exacerbate low flow conditions, impacting rearing habitat and access to spawning areas.
22. Residential septic system failures cause water quality contamination and excessive nutrient loading.
23. Agricultural activities cause water quality contamination and excessive nutrient loading.
24. Industrial activities in the Port Gardner area impact chinook salmon recovery through contaminating water quality.
25. Past mining operations continue to contaminate water quality.
26. Poaching of adults.
27. Predation on adults.
28. Disease.
29. Predation on juveniles.
30. Competition from introduced species.
31. Low escapement goal.
32. Dredging in the estuary to eliminate fine sediment accumulation problem.
33. Reduced availability/abundance of food supply for juveniles.
34. Adult migration hampered by lack of holding habitat (pools, log jams, etc.).

Table E-3: WRIA 10 - White River Sub-basin - Key Findings

Excerpt from: Kerwin, J. 1999. *Salmon Habitat Limiting factors Report for the Puyallup River Basin.* Washington Conservation Commission. Olympia, WA. 98 pp.

- Mud Mountain Dam and the Lake Tapps Hydroelectric Project adversely limit natural production of salmonids through several means.
- Mud Mountain Dam interrupts the recruitment of LWD and the natural sediment flow regime, and adversely impacts salmonid migration and production.
- Water quality may be impaired due to high sediment and turbidity loads in specific subbasins in the upper watershed.
- The Lake Tapps Hydroelectric Project significantly adversely impacts salmonid production through adverse attraction and lack of suitable low flow regimes in the bypass reach of the White River.
- Flood control practices have adversely impacted fish production throughout the basin. The removal of riparian vegetation, construction levees and revetments and removal of LWD posed significant adverse impacts on natural production of salmonids.
- Water quality parameters are exceeded in the vicinity of the White River because of sanitary sewage effluent from the cities of Buckley and Enumclaw.
- Data from the drainages studied in this subbasin on temperature, spawning gravels, large woody debris and holding pools indicates the chinook beneficial uses are currently poorly supported.
- There exist numerous barriers to adult and juvenile salmonids on tributary streams throughout this subbasin.

Data Gaps - White River Subbasin

- Additional data on presence and distribution anadromous salmonids and native char needs to be collected.
- Freshwater life history data needs to be collected, including spawning run timing of all species of naturally produced salmonids.
- Information about the marine life history of salmonids within the basin needs to be collected and analyzed.
- A sediment budget for the White River needs to be prepared.

- Existing flood control facilities and opportunities to restore floodplain and off-channel salmonid habitat restoration opportunities need to be identified and mapped.

- Development of baseline data on habitat utilization by salmonid species in the subbasin needs to be addressed for effective management of the watershed.

Table E-4: A list of all waterbodies within King County that are listed under Section 303(d) of the Clean Water Act for exceeding various water quality parameters.

WRIA	Waterbody Name	Parameter	Township	Range	Section	New ID #	Old ID #
7	RAGING RIVER	pH	24N	07E	15	GU12TT	WA-07-1104
7	SNOQUALMIE RIVER	Temperature	24N	07E	14	QW73YS	WA-07-1100
7	SNOQUALMIE RIVER	Temperature	24N	08E	30	QW73YS	WA-07-1100
7	SNOQUALMIE RIVER	Temperature	24N	08E	33	QW73YS	WA-07-1100
7	SNOQUALMIE RIVER	Temperature	25N	07E	09	QW73YS	WA-07-1060
7	SNOQUALMIE RIVER	Temperature	26N	06E	26	QW73YS	WA-07-1060
7	SNOQUALMIE RIVER, S.F.	pH	23N	09E	30	UC46QU	WA-07-1120
7	SNOQUALMIE RIVER, S.F.	pH	23N	09E	34	UC46QU	WA-07-1120
7	SNOQUALMIE RIVER, S.F.	Temperature	22N	10E	06	UC46QU	WA-07-1120
8	BEAR-EVANS CREEKS	Fecal Coliform	25N	05E	12	WR69YU	WA-08-1095
8	BEAR-EVANS CREEKS	Fecal Coliform	25N	06E	06	BA64JJ	WA-08-1095
8	BEAR-EVANS CREEKS	Fecal Coliform	25N	06E	06	M167EG	WA-08-1095
8	BEAR-EVANS CREEKS	Fecal Coliform	25N	06E	18	M167EG	WA-08-1095
8	BEAR-EVANS CREEKS	Fecal Coliform	26N	06E	18	N074JS	WA-08-1095
8	BEAR-EVANS CREEKS	Fecal Coliform	26N	06E	30	EEW54V	WA-08-1095
8	BEAR-EVANS CREEKS	Mercury	25N	05F	12	WR69YU	WA-08-1095
8	BEAVER NO. 1 LAKE	Total Phosphorus	24N	06E	02	135STD	WA-08-9020
8	BEAVER NO. 2 LAKE	Total Phosphorus	24N	06E	11	0050QX	WA-08-9030
8	CEDAR RIVER	Fecal Coliform	23N	06E	29	JG09GH	WA-08-1145
8	COAL CREEK	Fecal Coliform	24N	05E	16	CH04N	WA-08-1120

WRIA	Waterbody Name	Parameter	Township	Range	Section	New ID #	Old ID #
8	COTTAGE LAKE	Total Phosphorus	26N	06E	07	491TVC	WA-08-9070
8	EDEN (ETON) CREEK	Fecal Coliform	25N	06E	32	FN75VG	WA-08-1118
8	FAIRWEATHER BAY CREEK	Fecal Coliform	25N	04E	24	DG67DF	WA-08-1016
8	FAIRWEATHER BAY CREEK	Temperature	25N	04E	24	DG67DF	WA-08-101
8	FORBES CREEK	Fecal Coliform	26N	05E	31	BG76BX	WA-08-1012
8	GREEN LAKE	Total Phosphorus	25N	04E	05	670DAB	WA-08-9150
8	ISSAQUAH CREEK	Fecal Coliform	24N	06E	21	TF310B	WA-08-11 10
8	ISSAQUAH CREEK	Fecal Coliform	24N	06E	27	CZ80NC	WA-08-1110
8	ISSAQUAH CREEK	Fecal Coliform	24N	06E	28	TF310B	WA-08-1110
8	ISSAQUAH CREEK	Temperature	24N	06E	28	CN80NC	WA-08-1110
8	JUANITA CREEK	Fecal Coliform	26N	05E	20	WA69TP	WA-08-1010
8	JUANITA CREEK	Fecal Coliform	26N	05E	30	WA69TP	WA-08-1010
8	KELSEY CREEK	DDT	25N	05E	27	UD45VL	WA-08-1018
8	KELSEY CREEK	Dieldrin	25N	05E	27	UD45VL	WA-08-1018
8	KELSEY CREEK	Fecal Coliform	24N	05E	08	CK50FE	WA-08-1018
8	KELSEY CREEK	Fecal Coliform	25N	05E	33	CK50FE	WA-08-1018
8	KELSEY CREEK	Heptachlor Epoxide	25N	05E	27	UD45VL	WA-08-1018
8	LAUGHING JACOBS CREEK	Fecal Coliform	24N	06E	16	AM27GW	WA-08-1116
8	LEWIS CREEK	Fecal Coliform	24N	06E	18	SY87QV	None24
8	LITTLE BEAR CREEK	Fecal Coliform	26N	05E	09	UT96KR	WA-08-1085
8	LITTLE BEAR CREEK	Fecal Coliform	27N	05E	15	UT96KR	WA-08-1085
8	LITTLE BEAR CREEK	Fecal Coliform	27N	05E	27	UT96KR	WA-08-1085

WRIA	Waterbody Name	Parameter	Township	Range	Section	New ID #	Old ID #
8	LYON CREEK	Fecal Coliform	26N	04E	10	AS70QO	WA-08-1040
8	MARTHA LAKE	Total Phosphorus	27N	04E	01	855WHN	WA-08-9190
8	MAY CREEK	Copper	23N	06E	07	BH96KG	WA-08-1130
8	MAY CREEK	Copper	24N	05E	32	BH96KG	WA-08-1130
8	MAY CREEK	Copper	24N	05E	33	BH96KG	WA-08-1130
8	MAY CREEK	Fecal Coliform	24N	05E	32	BH96KG	WA-08-1130
8	MAY CREEK	Lead	23N	06E	07	BH96KG	WA-08-1130
8	MAY CREEK	Lead	23N	06E	18	XP04PY	WA-08-1130
8	MAY CREEK	Lead	24N	05E	32	BH96KG	WA-08-1130
8	MAY CREEK	Lead	24N	05F	34	BG47ND	WA-08-1130
8	MAY CREEK	Temperature	23N	05E	04	BH96KG	WA-08-1130
8	MAY CREEK	Temperature	23N	05E	12	BG47ND	WA-08-1130
8	MAY CREEK	Temperature	23N	05E	12	BH96KG	WA-08-1130
8	MAY CREEK	Zinc	24N	05E	32	BH96KG	WA-08-1130
8	MAY CREEK	Zinc	24N	05E	32	H96KG	WA-08-1130
8	McALEER CREEK	Fecal Coliform	26N	04E	10	CF07LH	WA-08-1030
8	MERCER SLOUGH	Dissolved Oxygen	24N	05E	05	DE87MT	WA-08-2100
8	MERCER SLOUGH	Dissolved Oxygen	25N	05E	33	CK50FE	WA-08-2100
8	MERCER SLOUGH	Fecal Coliform	24N	05E	05	DE87MT	WA-08-2100
8	MERCER SLOUGH	pH	24N	05E	08	CK50FE	WA-08-2100
8	MULLEN SLOUGH	Fecal Coliform	22N	04E	23	BP27QP	None23
8	NORMA CREEK	Dissolved Oxygen	28N	04E	32	Y162JI	WA-08-1002

WRIA	Waterbody Name	Parameter	Township	Range	Section	New ID #	Old ID #
8	NORMA CREEK	Dissolved Oxygen	28N	04E	32	Y162JI	WA-08-1002
8	NORMA CREEK	Fecal Coliform	28N	04E	32	Y162JI	WA-08-1002
8	NORMA CREEK	Fecal Coliform	28N	04E	32	Y162JI	WA-08-1002
8	NORTH CREEK	Dissolved Oxygen	27N	05E	32	SM74QQ	WA-08-1065
8	NORTH CREEK	Dissolved Oxygen	28N	05E	31	SM74QQ	WA-08-1065
8	NORTH CREEK	Fecal Coliform	26N	05E	04	SM74QQ	WA-08-1065
8	NORTH CREEK	Fecal Coliform	27N	05E	32	SM74QQ	WA-08-1065
8	NORTH CREEK	Fecal Coliform	28N	05E	31	SM74QQ	WA-08-1065
8	PINE LAKE CREEK	Fecal Coliform	25N	06E	31	LH94AN	WA-08-1117
8	PUGET SOUND (CENTRAL)	2-Methylnaphthalene				390KRD	WA-PS-0240
8	PUGET SOUND (CENTRAL)	Acenaphthene				390KRD	WA-PS-0240
8	PUGET SOUND (CENTRAL)	Benz(a)anthracene				390KRD	WA-PS-0240
8	PUGET SOUND (CENTRAL)	Benzo(a)pyrene				390KRD	WA-PS-0240
8	PUGET SOUND (CENTRAL)	Benzo(b,k)fluoranthenes				390KRD	WA-PS-0240
8	PUGET SOUND (CENTRAL)	Benzo(ghi)perylene				390KRD	WA-PS-0240
8	PUGET SOUND (CENTRAL)	Chrysene				390KRD	WA-PS-0240
8	PUGET SOUND (CENTRAL)	Dibenz(a,h)anthracene				390KRD	WA-PS-0240
8	PUGET SOUND (CENTRAL)	Dibenzoforan				390KRD	WA-PS-0240
8	PUGET SOUND (CENTRAL)	Fluoranthene				390KRD	WA-PS-0240

WRIA	Waterbody Name	Parameter	Township	Range	Section	New ID #	Old ID #
8	PUGET SOUND (CENTRAL)	Fluorene				390KRD	WA-PS-0240
8	PUGET SOUND (CENTRAL)	Indeno(1,2,3-cd)pyrene				390KRD	WA-PS-0240
8	PUGET SOUND (CENTRAL)	Mercury				390KRD	WA-PS-0240
8	PUGET SOUND (CENTRAL)	Naphthalene				390KRD	WA-PS-0240
8	PUGET SOUND (CENTRAL)	Phenanthrene				390KRD	WA-PS-0240
8	PUGET SOUND (CENTRAL)	Total PCBs				390KRD	WA-PS-0240
8	SAMMAMISH LAKE	Fecal Coliform				143MLR	WA-08-9270
8	SAMMAMISH LAKE	Fecal Coliform				143MLR	WA-08-9270
8	SAMMAMISH RIVER	Dissolved Oxygen	26N	05E	08	CA16HI	WA-08-1070
8	SAMMAMISH RIVER	Fecal Coliform	25N	05E	11	CA16HI	WA-08-1090
8	SAMMAMISH RIVER	Fecal Coliform	25N	05E	11	CA16HI	WA-08-1100
8	SAMMAMISH RIVER	Fecal Coliform	26N	04E	12	ZC89FB	WA-08-1050
8	SAMMAMISH RIVER	Fecal Coliform	26N	05E	08	CA16HI	WA-08-1070
8	SAMMAMISH RIVER	pH	25N	05E	11	CA16HI	WA-08-1 100
8	SAMMAMISH RIVER	Temperature	25N	05E	11	CA16HI	WA-08-1 100
8	SAMMAMISH RIVER	Temperature	26N	04E	12	ZC89FB	WA-08-1050
8	SAMMAMISH RIVER	Temperature	26N	05E	08	CA16HI	WA-08-1070
8	SCRIBER LAKE	Total Phosphorus	27N	04E	21	414VNQ	WA-08-9280
8	SILVER LAKE	Fecal Coliform	28N	05E	30	740PLK	WA-08-9300
8	SWAMP CREEK	Dissolved Oxygen	26N	04E	02	GJ57UL	WA-08-1060
8	SWAMP CREEK	Dissolved Oxygen	26N	04E	12	GJ57UL	WA-08-1060
8	SWAMP CREEK	Dissolved Oxygen	27N	04E	02	GJ57UL	WA-08-1060

WRIA	Waterbody Name	Parameter	Township	Range	Section	New ID #	Old ID #
8	SWAMP CREEK	Fecal Coliform	26N	04E	02	GJ57UL	WA-08-1060
8	SWAMP CREEK	Fecal Coliform	27N	04E	02	GJ57UL	WA-08-1060
8	THORNTON CREEK	Fecal Coliform	26N	04E	34	VQ98YZ	WA-08-1020
8	TIBBETTS CREEK	Fecal Coliform	24N	06E	20	MB51QQ	WA-08-1115
8	TIBBETTS CREEK	Fecal Coliform	24N	06E	29	EA48LQ	WA-08-1115
8	UNION LAKE / LAKE WASHINGTON SHIP CANAL	Dieldrin	25N	04E	19	043HCN	WA-08-9340
8	UNION LAKE / LAKE WASHINGTON SHIP CANAL	Sediment Bioassay	25N	04E	19	043HCN	WA-08-9340
8	WASHINGTON LAKE	Fecal Coliform				213HVK	WA-08-9350
8	WASHINGTON LAKE	Fecal Coliform				213HVK	WA-08-9350
8	WASHINGTON LAKE	Fecal Coliform				213HVK	WA-08-9350
8	WASHINGTON LAKE	Fecal Coliform				213HVK	WA-08-9350
8	WASHINGTON LAKE	Fecal Coliform				213HVK	WA-08-9350
8	WASHINGTON LAKE	Fecal Coliform				213HVK	WA-08-9350
8	WASHINGTON LAKE	Fecal Coliform				213HVK	WA-08-9350
8	WASHINGTON LAKE	Fecal Coliform				213HVK	WA-08-9350
8	WASHINGTON LAKE	Fecal Coliform				213HVK	WA-08-9350
8	WASHINGTON LAKE	Fecal Coliform				213HVK	WA-08-9350
8	WASHINGTON LAKE	Fecal Coliform				213HVK	WA-08-9350
8	WASHINGTON LAKE	Fecal Coliform	25N	04E	16	213HVK	WA-08-9350
8	WASHINGTON LAKE	Fecal Coliform	25N	04E	16	213HVK	WA-08-9350
8	WASHINGTON LAKE	Fecal Coliform	25N	04E	16	213HVK	WA-08-9350

WRIA	Waterbody Name	Parameter	Township	Range	Section	New ID #	Old ID #
8	WASHINGTON LAKE	Fecal Coliform	25N	04E	16	213HVK	WA-08-9350
8	WASHINGTON LAKE	Fecal Coliform	25N	04E	16	213HVK	WA-08-9350
8	WASHINGTON LAKE	Fecal Coliform	25N	04E	16	213HVK	WA-08-9350
8	WASHINGTON LAKE	Fecal Coliform	25N	04E	16	213HVK	WA-08-9350
8	WASHINGTON LAKE	Sediment Bioassay	25N	04E	16	213HVK	WA-08-9350
8	YARROW BAY CREEK	Fecal Coliform	25N	05E	17	IE91MG	WA-08-1014
9	COLD SPRINGS CREEK	Fecal Coliform	22N	04E	20	DR54QH	WA-09-2010
9	CRISP CREEK	Fecal Coliform	21N	06E	20	SM16VT	None26
9	DES MOINES CREEK	Fecal Coliform	22N	04E	08	VX71MY	WA-09-2000
9	DUWAMISH WATERWAY AND RIVER	1,2,4-Trichloroben zene	24N	04E	07	IG58VD	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	1,4-Dichlorobenze ne	24N	03E	13	DH90GX	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	1,4-Dichlorobenzei ie	24N	04E	07	IG58VD	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	1,4-Diclilorobenze ne	24N	04E	18	IG58VD	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	1,4-Dichlorobenze ne	24N	04E	19	IG58VD	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	2,4-Dimethylphen ol	24N	03E	12	DH90GX	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	2-Methylnaphthale ne	24N	04E	19	IG58VD	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	4-Methylphenol	24N	03E	12	DH90GX	WA-09-1010

WRIA	Waterbody Name	Parameter	Township	Range	Section	New ID #	Old ID #
9	DUWAMISH WATERWAY AND RIVER	Acenaphthene	24N	03E	12	DH90GX	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Acenaphthene	24N	03E	13	DH90GX	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Acenaphthene	24N	04E	07	IG58VD	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Acenaphthene	24N	04E	18	DH90GX	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Acenaphthene	24N	04E	19	IG58VD	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Anthracene	24N	04E	07	IG58VD	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Arsenic	24N	03E	12	DH90GX	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Arsenic	24N	04E	07	IG58VD	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Arsenic	24N	04E	18	DH90GX	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Arsenic	24N	04E	19	IG58VD	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Arsenic	24N	04E	30	IG58VD	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Benz(a)anthracene	24N	03E	12	DH90GX	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Benz(a)anthracene	24N	03E	13	DH90GX	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Benz(a)anthracene	24N	04E	07	IG58VD	WA-09-1010

WRIA	Waterbody Name	Parameter	Township	Range	Section	New ID #	Old ID #
9	DUWAMISH WATERWAY AND RIVER	Benzo(a)pyrene	24N	03E	12	DH90GX	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Benzo(a)pyrene	24N	03E	13	DH90GX	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Benzo(a)pyrene	24N	04E	19	IG58VD	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Benzo(b,k)fluoranthenes	24N	03E	12	DH90GX	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Benzo(b,k)fluoranthenes	24N	03E	13	DH90GX	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Benzo(ghi)perylene	24N	03E	12	DH90GX	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Benzo(ghi)perylene	24N	03E	13	DH90GX	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Benzo(ghi)perylene	24N	04E	07	IG58VD	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Benzo(ghi)perylene	24N	04E	18	IG58VD	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Benzoic acid	24N	04E	18	DH90GX	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Benzoic acid	24N	04E	18	IG58VD	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Benzoic acid	24N	04E	19	IG58VD	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Benzyl alcohol	24N	03E	12	DH90GX	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Bis(2-ethylhexyl) plithalate	24N	03E	12	DH90GX	WA-09-1010

WRIA	Waterbody Name	Parameter	Township	Range	Section	New ID #	Old ID #
9	DUWAMISH WATERWAY AND RIVER	Bis(2-ethylhexyl) phthalate	24N	04E	07	IG58VD	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Bis(2-ethylhexyl) phthalate	24N	04E	18	DH90GX	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Bis(2-ethylhexyl) plithalate	24N	04E	18	IG58VD	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Bis(2-ethylhexyl) phthalate	24N	04E	19	IG58VD	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Butylbenzyl plithalate	24N	03E	12	DH90GX	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Butylbenzyl phthalate	24N	04E	07	IG58VD	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Butylbenzyl phthalate	24N	04E	18	IG58VD	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Butylbenzyl phthalate	24N	04E	19	IG58VD	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Cadmium	24N	03E	12	DH90GX	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Cadmium	24N	03E	13	DH90GX	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Cadmium	24N	04E	07	IG58VD	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Cadmium	24N	04E	18	DH90GX	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Cadmium	24N	04E	19	IG58VD	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Cadmium	24N	04e	30	IG58VD	WA-09-1010

WRIA	Waterbody Name	Parameter	Township	Range	Section	New ID #	Old ID #
9	DUWAMISH WATERWAY AND RIVER	Chromium	24N	03E	12	DH90GX	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Chrysene	24N	03E	12	DH90GX	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Chrysene	24N	03E	13	DH90GX	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Mysene	24N	04E	07	IG58VD	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Copper	24N	03E	12	DH90GX	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Copper	24N	04E	07	IG58VD	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Copper	24N	04E	19	IG58VD	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Dibenz(a,h)anthracene	24N	03E	12	DH90GX	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Dibenz(a,h)anthracene	24N	03E	13	DH90GX	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Dibenz(a,h)anthracene	24N	04E	07	IG58VD	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Dibenz(a,h)anthracene	24N	04E	18	IG58VD	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Dibenzofuran	24N	03E	12	DH90GX	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Dibenzofuran	24N	03E	13	DH90GX	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Dibenzofuran	24N	04E	07	IG58VD	WA-09-1010

WRIA	Waterbody Name	Parameter	Township	Range	Section	New ID #	Old ID #
9	DUWAMISH WATERWAY AND RIVER	Dibenzofuran	24N	04E	19	IG58VD	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Diethyl phthalate	24N	03E	12	DH90GX	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Dimethyl phthalate	24N	04E	18	DH90GX	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Dissolved Oxygen	24N	04E	32	SJ46KE	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Fecal Coliform	23N	04E	10	IG58VD	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Fecal Coliform	24N	04E	32	SJ46KE	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Fluoranthene	24N	03E	12	DH90GX	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Fluoranthene	24N	03E	13	DH90GX	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Fluoranthene	24N	04E	07	IG58VD	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Fluoranthene	24N	04E	19	IG58VD	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Fluorene	24N	03E	12	DH90GX	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Fluorene	24N	03E	13	DH90GX	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Fluorene	24N	04E	07	IG58VD	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Fluorene	24N	04E	19	IG58VD	WA-09-1010

WRIA	Waterbody Name	Parameter	Township	Range	Section	New ID #	Old ID #
9	DUWAMISH WATERWAY AND RIVER	Fluorene	24N	04E	07	IG58VD	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Hexachlorobenzene	24N	03E	12	DH90GX	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Indeno(1,2,3-cd)pyrene	24N	04E	19	IG58VD	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Indeno(1,2,3-cd)pyrene	24N	03E	12	DH90GX	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Indeno(1,2,3-cd)pyrene	24N	03E	13	DH90GX	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Indeno(1,2,3-cd)pyrene	24N	04E	07	IG58VD	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Lead	24N	03E	12	DH90GX	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Lead	24N	04E	07	IG58VD	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Lead	24N	04E	18	DH90GX	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Lead	24N	04E	19	IG58VD	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Mercury	24N	03E	12	DH90GX	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Mercury	24N	03E	13	DH90GX	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Mercury	24N	04E	07	IG58VD	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Mercury	24N	04E	18	DH90GX	WA-09-1010

WRIA	Waterbody Name	Parameter	Township	Range	Section	New ID #	Old ID #
9	DUWAMISH WATERWAY AND RIVER	Mercury	24N	04E	18	IG58VD	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Mercury	24N	04E	19	IG58VD	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	N-nitrosodiphenyla mine	24N	03E	12	DH90GX	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Naphthalene				390KRD	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Naphthalene	24N	04E	07	IG58VD	WA-09-1010
9	DUWAMISH WATERWAY	PAHs	24N	04E	07	IG59VD	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	PCB-1254	24N	03E	12	DH90GX	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	PCB-1260	24N	03E	12	DH90GX	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	pH	23N	04E	04	IG58VD	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	pH	23N	04E	09	IG58VD	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	pH	23N	04E	11	IG58VD	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	pH	24N	04E	18	IG58VD	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	pH	24N	04E	19	IG58VD	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	pH	24N	04E	29	IG58VD	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	pH	24N	04E	30	IG58VD	WA-09-1010

WRIA	Waterbody Name	Parameter	Township	Range	Section	New ID #	Old ID #
	RIVER						
9	DUWAMISH WATERWAY AND RIVER	pH	24N	04E	33	IG58VD	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Phenanthrene	24N	03E	12	DH90GX	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Phenanthrene	24N	03E	13	DH90GX	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Phenanthrene	24N	04E	07	IG58VD	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Phenanthrene	24N	04E	18	DH90GX	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Phenanthrene	24N	04E	19	IG58VD	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Phenol	24N	03E	12	DH90GX	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Phenol	24N	03E	13	DH90GX	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Phenol	24N	04E	07	IG58VD	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Phenol	24N	04E	18	DH90GX	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Phenol	24N	04E	19	IG58VD	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Pyrene	24N	03E	13	DH90GX	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Sediment Bioassay	24N	04E	07	IG59VD	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Silver	24N	04E	18	IG58VD	WA-09-1010

WRIA	Waterbody Name	Parameter	Township	Range	Section	New ID #	Old ID #
	RIVER						
9	DUWAMISH WATERWAY AND RIVER	Silver	24N	04E	19	IG58VD	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Total PCBs	24N	03E	12	DH90GX	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Total PCBs	24N	03E	13	DH90GX	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Total PCBs	24N	04E	07	IG58VD	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Total PCBs	24N	04E	07	IG59VD	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Total PCBs	24N	04E	18	DH90GX	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Total PCBs	24N	04E	19	IG58VD	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Total PCBs	24N	04E	30	IG58VD	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Zinc	24N	03E	12	DH90GX	WA-094010
9	DUWAMISH WATERWAY AND RIVER	Zinc	24N	04E	07	IG58VD	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Zinc	24N	04E	18	DH90GX	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Zinc	24N	04E	18	IG58VD	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Zinc	24N	04E	19	IG58VD	WA-09-1010
9	DUWAMISH WATERWAY AND RIVER	Zinc	24N	04E	30	IG58VD	WA-09-1010

WRIA	Waterbody Name	Parameter	Township	Range	Section	New ID #	Old ID #
	RIVER						
9	ELLIOTT BAY	1,2,4-Trichlorobenzene				390KRD	WA-09-0010
9	ELLIOTT BAY	1,4-Dichlorobenzene				390KRD	WA-09-0010
9	ELLIOTT BAY	1,4-Dichlorobenzene				390KRD	WA-09-0010
9	ELLIOTT BAY	2,4-Dimethylphenol				390KRD	WA-09-0010
9	ELLIOTT BAY	2,4-Dimethylphenol				390KRD	WA-09-0010
9	ELLIOTT BAY	2,4-Diinethylphenol				390KRD	WA-09-0010
9	ELLIOTT BAY	2-Methylnaphthalene				390KRD	WA-09-0010
9	ELLIOTT BAY	2-Methylnaphthalene				390KRD	WA-09-0010
9	ELLIOTT BAY	Acenaphthene				390KRD	WA-09-0010
9	ELLIOTT BAY	Acenaphthene				390KRD	WA-09-0010
9	ELLIOTT BAY	Acenaphthene				390KRD	WA-09-0010
9	ELLIOTT BAY	Acenaphthene				390KRD	WA-09-0010
9	ELLIOTT BAY	Acenaphthylene				390KRD	WA-09-0010
9	ELLIOTT'BAY	Anthracene				390KRD	WA-09-0010
9	ELLIOTT BAY	Anthracene				390KRD	WA-09-0010
9	ELLIOTT BAY	Arsenic				390KRD	WA-09-0010
9	ELLIOTT BAY	Arsenic				390KRD	WA-09-0010

WRIA	Waterbody Name	Parameter	Township	Range	Section	New ID #	Old ID #
9	ELLIOTT BAY	Arsenic				390KRD	WA-09-0010
9	ELLIOTT BAY	Benz(a)anthracene				390KRD	WA-09-0010
9	ELLIOTT BAY	Benz(a)anthracene				390KRD	WA-09-0010
9	ELLIOTT BAY	Benzo(a)pyrene				390KRD	WA-09-0010
9	ELLIOTT BAY	Benzo(a)pyrene				390KRD	WA-09-0010
9	ELLIOTT BAY	Benzo(a)pyrene				390KRD	WA-09-0010
9	ELLIOTT BAY	Benzo(b,k)fluoranthenes				390KRD	WA-09-0010
9	ELLIOTT BAY	Benzo(b,k)fluoranthenes				390KRD	WA-09-0010
9	ELLIOTT BAY	Benzo(b,k)fluoranthenes				390KRD	WA-09-0010
9	ELLIOTT BAY	Benzo(ghi)perylene				390KRD	WA-09-0010
9	ELLIOTT BAY	Benzo(ghi)perylene				390KRD	WA-09-0010
9	ELLIOTT BAY	Benzo(ghi)perylene				390KRD	WA-09-0010
9	ELLIOTT BAY	Benzo(ghi)perylene				390KRD	WA-09-0010
9	ELLIOTT BAY	Benzo(ghi)perylene				390KRD	WA-09-0010
9	ELLIOTT BAY	Benzo(ghi)perylene				390KRD	WA-09-0010
9	ELLIOTT BAY	Benzoic acid				390KRD	WA-09-0010

WRIA	Waterbody Name	Parameter	Township	Range	Section	New ID #	Old ID #
9	ELLIOTT BAY	Benzyl alcohol				390KRD	WA-09-0010
9	ELLIOTT BAY	Bis(2-ethylhexyl) plithalate				390KRD	WA-09-0010
9	ELLIOTT BAY	Bis(2-etliylliexyl) phthalate				390KRD	WA-09-0010
9	ELLIOTT BAY	Bis(2-ethylhexyl)) phthalate				390KRD	WA-09-0010
9	ELLIOTT BAY	Bis(2-etliylhexyl) phthalate				390KRD	WA-09-0010
9	ELLIOTT BAY	Butylbenzyl phthalate				390KRD	WA-09-0010
9	ELLIOTT BAY	Butylbenzyl phthalate				390KRD	WA-09-0010
9	ELLIOTT BAY	Cadmium				390KRD	WA-09-0010
9	ELLIOTT BAY	Cadmium				390KRD	WA-09-0010
9	ELLIOTT BAY	Cadmium				390KRD	WA-09-0010
9	ELLIOTT BAY	Chromium				390KRD	WA-09-0010
9	ELLIOTT BAY	Chromium				390KRD	WA-09-0010
9	ELLIOTT BAY	Chrysene				390KRD	WA-09-0010
9	ELLIOTT BAY	Chrysene				390KRD	WA-09-0010
9	ELLIOTT BAY	Chrysene				390KRD	WA-09-0010
9	ELLIOTT BAY	Copper				390KRD	WA-09-0010
9	ELLIOTT BAY	Copper				390KRD	WA-09-0010
9	ELLIOTT BAY	Copper				390KRD	WA-09-0010
9	ELLIOTT BAY	Copper				390KRD	WA-09-0010

WRIA	Waterbody Name	Parameter	Township	Range	Section	New ID #	Old ID #
9	ELLIOTT BAY	Copper				390KRD	WA-09-0010
9	ELLIOTT BAY	Di-n-octyl phthalate				390KRD	WA-09-0010
9	ELLIOTT BAY	Dibenz(a,h)anthracene				390KRD	WA-09-0010
9	ELLIOTT BAY	Dibenz(a,h)anthracene				390KRD	WA-09-0010
9	ELLIOTT BAY	Dibenz(a,h)anthracene				390KRD	WA-09-0010
9	ELLIOTT BAY	Dibenz(a,h)anthracene				390KRD	WA-09-0010
9	ELLIOTT BAY	Dibenzo(a,h)anthracene				390KRD	WA-09-0010
9	ELLIOTT BAY	Dibenzofuran				390KRD	WA-09-0010
9	ELLIOTT BAY	Dibenzofuran				390KRD	WA-09-0010
9	ELLIOTT BAY	Dibenzofuran				390KRD	WA-09-0010
9	ELLIOTT BAY	Dibenzofuran				390KRD	WA-09-0010
9	ELLIOTT BAY	Diethyl phthalate				390KRD	WA-09-0010
9	ELLIOTT BAY	Fecal Coliform				390KRD	WA-09-0010
9	ELLIOTT BAY	Fecal Coliform				390KRD	WA-09-0010
9	ELLIOTT BAY	Fecal Coliform				390KRD	WA-09-0010
9	ELLIOTT BAY	Fluoranthene				390KRD	WA-09-0010
9	ELLIOTT BAY	Fluoranthene				390KRD	WA-09-0010
9	ELLIOTT BAY	Fluoranthene				390KRD	WA-09-0010
9	ELLIOTT BAY	Fluoranthene				390KRD	WA-09-0010

WRIA	Waterbody Name	Parameter	Township	Range	Section	New ID #	Old ID #
9	ELLIOTT BAY	Fluorene				390KRD	WA-09-0010
9	ELLIOTT BAY	Fluorene				390KRD	WA-09-0010
9	ELLIOTT BAY	Fluorene				390KRD	WA-09-0010
9	ELLIOTT BAY	Fluorene				390KRD	WA-09-0010
9	ELLIOTT BAY	Fluorene				390KRD	WA-09-0010
9	ELLIOTT BAY	Hexachlorobenzene				390KRD	WA-09-0010
9	ELLIOTT BAY	HPAH				390KRD	WA-09-0010
9	ELLIOTT BAY	Indeno(1,2,3-cd)pyrene				390KRD	WA-09-0010
9	ELLIOTT BAY	Indeno(1,2,3-cd)pyrene				390KRD	WA-09-0010
9	ELLIOTT BAY	Indeno(1,2,3-cd)pyrene				390KRD	WA-09-0010
9	ELLIOTT BAY	Indeno(1,2,3-cd)pyrene				390KRD	WA-09-0010
9	ELLIOTT BAY	Indeno(1,2,3-cd)pyrene				390KRD	WA-09-0010
9	ELLIOTT BAY	Lead				390KRD	WA-09-0010
9	ELLIOTT BAY	Lead				390KRD	WA-09-0010
9	ELLIOTT BAY	Lead				390KRD	WA-09-0010
9	ELLIOTT BAY	LPAH				390KRD	WA-09-0010
9	ELLIOTT BAY	Mercury				390KRD	WA-09-0010
9	ELLIOTT BAY	Mercury				390KRD	WA-09-0010
9	ELLIOTT BAY	Mercury				390KRD	WA-09-0010

WRIA	Waterbody Name	Parameter	Township	Range	Section	New ID #	Old ID #
9	ELLIOTT BAY	Mercury				390KRD	WA-09-0010
9	ELLIOTT BAY	Mercury				390KRD	WA-09-0010
9	ELLIOTT BAY	Mercury				390KRD	WA-09-0010
9	ELLIOTT BAY	Mercury				390KRD	WA-09-0010
9	ELLIOTT BAY	N-nitrosodiphenyla rnine				390KRD	WA-09-0010
9	ELLIOTT BAY	Naphthalene				390KRD	WA-09-0010
9	ELLIOTT BAY	Naphthalene				390KRD	WA-09-0010
9	ELLIOTT BAY	Pentachlorophenol				390KRD	WA-09-0010
9	ELLIOTT BAY	Phenanthrene				390KRD	WA-09-0010
9	ELLIOTT BAY	Phenanthrene				390KRD	WA-09-0010
9	ELLIOTT BAY	Phenanthrene				390KRD	WA-09-0010
9	ELLIOTT BAY	PhenaDthrene				390KRD	WA-09-0010
9	ELLIOTT BAY	Phenanthrene				390KRD	WA-09-0010
9	ELLIOTT BAY	Phenol				390KRD	WA-09-0010
9	ELLIOTT BAY	Pyrene				390KRD	WA-09-0010
9	ELLIOTT BAY	Pyrene				390KRD	WA-09-0010
9	ELLIOTT BAY	Sediment Bioassay				390KRD	WA-09-0010
9	ELLIOTT BAY	Silver				390KRD	WA-09-0010
9	ELLIOTT BAY	Total PCBs				390KRD	WA-09-0010
9	ELLIOTT BAY	Total PCBs				390KRD	WA-09-0010
9	ELLIOTT BAY	Total PCBs				390KRD	WA-09-0010

WRIA	Waterbody Name	Parameter	Township	Range	Section	New ID #	Old ID #
9	ELLIOTT BAY	Total PCBs				390KRD	WA-09-0010
9	ELLIOTT BAY	Total PCBs				390KRD	WA-09-0010
9	ELLIOTT BAY	Total PCBs				390KRD	WA-09-0010
9	ELLIOTT BAY	Zinc				390KRD	WA-09-0010
9	ELLIOTT BAY	Zinc				390KRD	WA-09-0010
9	ELLIOTT BAY	Zinc				390KRD	WA-09-0010
9	ELLIOTT BAY	Zinc				390KRD	WA-09-0010
9	FAUNTLEROY CREEK	Fecal Coliform	24N	03E	35	BS29QB	WA-09-1005
9	FAUNTLEROY CREEK	Fecal Coliform	24N	03E	99	BS29QB	WA-09-1005
9	GALE CREEK	Temperature	21N	08E	36	ML05JG	WA-09-1041
9	GREEN RIVER	Chromium	22N	04E	11	YD05HE	WA-09-1020
9	GREEN RIVER	Chromium	23N	04E	24	YD05HE	WA-09-1020
9	GREEN RIVER	Fecal Coliform	21N	05E	21	YD05HE	WA-09-1020
9	GREEN RIVER	Fecal Coliform	22N	04E	11	YD05HE	WA-09-1020
9	GREEN RIVER	Fecal Coliform	23N	04E	24	YD05HE	WA-09-1020
9	GREEN RIVER	Fecal Coliform	23N	04E	25	YD05HE	WA-09-1020
9	GREEN RIVER	Mercury	22N	04E	11	YD05HE	WA-09-1020
9	GREEN RIVER	Mercury	23N	04E	24	YD05HE	WA-09-1020
9	GREEN RIVER	Mercury	23N	04E	25	YD05HE	WA-09-1020
9	GREEN RIVER	Temperature	21N	05E	22	AJ33YB	WA-09-1020
9	GREEN RIVER	Temperature	21N	06E	29	YD05HE	WA-09-1020
9	GREEN RIVER	Temperature	21N	08E	18	AB620X	WA-09-1030

WRIA	Waterbody Name	Parameter	Township	Range	Section	New ID #	Old ID #
9	GREEN RIVER	Temperature	21N	08E	28	YD05HE	WA-09-1030
9	GREEN RIVER	Temperature	22N	04E	11	YD05HE	WA-09-1020
9	GREEN RIVER	Temperature	22N	04E	15	FK76HV	WA-09-1020
9	GREEN RIVER	Temperature	22N	05E	30	YD05HE	WA-09-1020
9	GREEN RIVER	Temperature	23N	04E	24	YD05HE	WA-09-1020
9	HICKS (GARRETT) LAKE	Fecal Coliform	23N	04E	06	322NQY	WA-09-9120
9	HICKS (GARRETT) LAKE	Total Phosphorus	23N	04E	06	322NQY	WA-09-9120
9	HILL (MILL) CREEK	Dissolved Oxygen	21N	04E	01	B199NR	WA-09-1022
9	HILL (MILL) CREEK	Dissolved Oxygen	22N	04E	25	B199NR	WA-09-1022
9	HILL (MILL) CREEK	Dissolved Oxygen	22N	04E	26	B199NR	WA-09-1022
9	HILL (MILL) CREEK	Dissolved Oxygen	22N	04E	35	B199NR	WA-09-1022
9	HILL (MILL) CREEK	Fecal Coliform	21N	04E	01	B199NR	WA-09-1022
9	HILL (MILL) CREEK	Fecal Coliform	21N	04E	15	B199NR	WA-09-1022
9	HILL (MILL) CREEK	Fecal Coliform	22N	04E	25	B199NR	WA-09-1022
9	HILL (MILL) CREEK	Fecal Coliform	22N	04E	25	B199NR	WA-09-1022
9	HILL (MILL) CREEK	Fecal Coliform	22N	04E	26	B199NR	WA-09-1022
9	HILL (MILL) CREEK	Fecal Coliform	22N	04E	35	B199NR	WA-09-1022
9	HILL (MILL) CREEK	Temperature	21N	04E	01	B199NR	WA-09-1022
9	HILL (MILL) CREEK	Temperature	22N	04E	25	B199NR	WA-09-1022
9	HILL (MILL) CREEK	Temperature	22N	04E	35	B199NR	WA-09-1022
9	JOE'S CREEK	Fecal Coliform	21N	03E	12	GV05FS	WA-09-2040
9	LAKOTA CREEK	Fecal Coliform	21N	03E	12	CN61UF	WA-09-2030

WRIA	Waterbody Name	Parameter	Township	Range	Section	New ID #	Old ID #
9	LONGFELLOW CREEK	Fecal Coliform	24N	03E	13	SM45HV	WA-09-1000
9	LONGFELLOW CREEK	Fecal Coliform	24N	03E	24	SM45HV	WA-09-1000
9	LONGFELLOW CREEK	Fecal Coliform	24N	03E	36	NO-ID	WA-09-1000
9	MERIDIAN LAKE	Fecal Coliform	22N	05E	27	148NFC	WA-09-9160
9	MERIDIAN LAKE	Total Phosphorus	22N	05E	27	148NFC	WA-09-9160
9	MULLEN SLOUGH	Dissolved Oxygen	22N	04E	23	BP27QP	None23
9	MULLEN SLOUGH	Dissolved Oxygen	22N	04E	26	BP27QP	None23
9	MULLEN SLOUGH	Fecal Coliform	22N	04E	26	BP27QP	None23
9	MULLEN SLOUGH	Temperature	22N	04E	23	BP27QP	None23
9	MULLEN SLOUGH	Temperature	22N	04E	26	BP27QP	None23
9	NEWAUKUM CREEK	Ammonia-N	21N	06E	03	JX80LS	WA-09-1028
9	NEWAUKUM CREEK	Dissolved Oxygen	20N	07E	07	LT44JU	WA-09-1028
9	NEWAUKUM CREEK	Fecal Coliform	20N	06E	10	JX80LS	WA-09-1028
9	NEWAUKUM CREEK	Fecal Coliform	20N	06E	12	JX80LS	WA-09-1028
9	NEWAUKUM CREEK	Fecal Coliform	20N	07E	07	JX80LS	WA-09-1028
9	NEWAUKUM CREEK	Fecal Coliform	20N	07E	07	LT44JU	WA-09-1028
9	NEWAUKUM CREEK	Fecal Coliform	20N	07E	07	RR29EG	WA-09-1028
9	NEWAUKUM CREEK	Fecal Coliform	20N	07E	09	LT44JU	WA-09-1028
9	NEWAUKUM CREEK	Fecal Coliform	21N	06E	03	JX80LS	WA-09-1028
9	NEWAUKUM CREEK	Fecal Coliform	21N	06E	28	KE55XH	WA-09-1028
9	PUGET SOUND (S-CENTRAL) AND EAST PASSAGE	Ammonia-N				390KRD	WA-PS-0270
9	PUGET SOUND (S-CENTRAL) AND EAST PASSAGE	Fecal Coliform				390KRD	WA-PS-0270

WRIA	Waterbody Name	Parameter	Township	Range	Section	New ID #	Old ID #
	AND EAST PASSAGE						
9	PUGET SOUND (S-CENTRAL) AND EAST PASSAGE	Fecal Coliform				390KRD	WA-PS-0270
9	PUGET SOUND (S-CENTRAL) AND EAST PASSAGE	Fecal Coliform				390KRD	WA-PS-0270
9	PUGET SOUND (S-CENTRAL) AND EAST PASSAGE	Fecal Coliform				390KRD	WA-PS-0270
9	PUGET SOUND (S-CENTRAL) AND EAST PASSAGE	Fecal Coliform				390KRD	WA-PS-0270
9	PUGET SOUND (S-CENTRAL) AND EAST PASSAGE	Fecal Coliform				390KRD	WA-PS-0270
9	PUGET SOUND (S-CENTRAL) AND EAST PASSAGE	Fecal Coliform				390KRD	WA-PS-0270
9	PUGET SOUND (S-CENTRAL) AND EAST PASSAGE	pH				390KRD	WA-PS-0270
9	REDONDO CREEK	Fecal Coliform	21N	04E	05	IF38BT	WA-09-2020
9	SMAY CREEK	Temperature	20N	09E	12	AX88SM	WA-09-1050
9	SOOS CREEK SYSTEM	Dissolved Oxygen	22N	05E	03	VY4301	WA-09-1026
9	SOOS CREEK SYSTEM	Dissolved Oxygen	22N	05E	10	VY4301	WA-09-1026
9	SOOS CREEK SYSTEM	Dissolved Oxygen	22N	05E	11	T191MT	WA-09-1026
9	SOOS CREEK SYSTEM	Dissolved Oxygen	22N	05E	28	GS67LK	WA-09-1026
9	SOOS CREEK SYSTEM	Dissolved Oxygen	22N	05E	33	HH34YJ	WA-09-1026
9	SOOS CREEK SYSTEM	Fecal Coliform	21N	05E	03	RX82DV	WA-09-1026
9	SOOS CREEK SYSTEM	Fecal Coliform	21N	05E	10	HH34YJ	WA-09-1026
9	SOOS CREEK SYSTEM	Fecal Coliform	21N	05E	16	VY4301	WA-09-1026

WRIA	Waterbody Name	Parameter	Township	Range	Section	New ID #	Old ID #
9	SOOS CREEK SYSTEM	Fecal Coliform	22N	05E	03	VY4301	WA-09-1026
9	SOOS CREEK SYSTEM	Fecal Coliform	22N	05E	11	T191MT	WA-09-1026
9	SOOS CREEK SYSTEM	Fecal Coliform	22N	05E	23	VY4301	WA-09-1026
9	SOOS CREEK SYSTEM	Fecal Coliform	22N	05E	26	T191MT	WA-09-1026
9	SOOS CREEK SYSTEM	Fecal Coliform	22N	05E	28	GS67LK	WA-09-1026
9	SOOS CREEK SYSTEM	Fecal Coliform	22N	05E	33	HH34YJ	WA-09-1026
9	SOOS CREEK SYSTEM	Fecal Coliform	22N	05E	36	NP20EM	WA-09-1026
9	SOOS CREEK SYSTEM	Temperature	22N	05E	24	T191MT	WA-09-1026
9	SPRINGBROOK (MILL) CREEK	Cadmium	22N	04E	01	TS53NN	WA-09-1015
9	SPRINGBROOK (MILL) CREEK	Cadmium	23N	04E	24	BY98ES	WA-09-1015
9	SPRINGBROOK (MILL) CREEK	Chromium	23N	04E	24	BY98ES	WA-09-1015
9	SPRINGBROOK (MILL) CREEK	Chromium	23N	04E	24	SQ03FA	WA-09-1015
9	SPRINGBROOK (MILL) CREEK	Copper	22N	04E	01	TS53NN	WA-09-1015
9	SPRINGBROOK (MILL) CREEK	Dissolved Oxygen	23N	04E	24	BY98ES	WA-09-1015
9	SPRINGBROOK (MILL) CREEK	Dissolved Oxygen	23N	04E	24	SQ03FA	WA-09-1015
9	SPRINGBROOK (MILL) CREEK	Dissolved Oxygen	23N	05E	23	XN07SY	WA-09-1015
9	SPRINGBROOK (MILL) CREEK	Fecal Coliform	23N	04E	24	BY98ES	WA-09-1015
9	SPRINGBROOK (MILL) CREEK	Fecal Coliform	23N	04E	24	SQ03FA	WA-09-1015
9	SPRINGBROOK (MILL) CREEK	Fecal Coliform	23N	05E	23	XN07SY	WA-09-1015
9	SPRINGBROOK (MILL) CREEK	Mercury	23N	04E	24	BY98ES	WA-09-1015
9	SPRINGBROOK (MILL) CREEK	Mercury	23N	04E	24	SQ03FA	WA-09-1015
9	SPRINGBROOK (MILL) CREEK	Sediment Bioassay	22N	04E	01	TS53NN	WA-09-1015

WRIA	Waterbody Name	Parameter	Township	Range	Section	New ID #	Old ID #
9	SPRINGBROOK (MILL) CREEK	Temperature	23N	04E	24	BY98ES	WA-09-1015
9	SPRINGBROOK (MILL) CREEK	Temperature	23N	04E	24	SQ03FA	WA-09-1015
9	SPRINGBROOK (MILL) CREEK	Zinc	22N	04E	01	TS53NN	WA-09-1015
9	SPRINGBROOK (MILL) CREEK	Zinc	23N	04E	24	BY98ES	WA-09-1015
9	UNNAMED CREEK WDF # 09.0046	Dissolved Oxygen	22N	04E	34	ZR70IJ	None25
9	UNNAMED CREEK WDF # 09.0046	Fecal Coliform	22N	04E	34	ZR70IJ	None25
10	BOISE CREEK	Temperature	20N	07E	27	CZ10IN	WA-10-1032
10	CLARKS CREEK	Fecal Coliform	20N	04E	18	PX29AG	WA-10-1025
10	CLARKS CREEK	Fecal Coliform	20N	04E	19	AD371U	WA-10-1025
10	CLARKS CREEK	Fecal Coliform	20N	04E	30	AD371U	WA-10-1025
10	CLARKS CREEK	Fecal Coliform	20N	04E	37	AD371U	WA-10-1025
10	CLARKS CREEK	Fecal Coliform	20N	04E	38	AD371U	WA-10-1025
10	CLARKS CREEK	pH	20N	04E	32	AD371U	WA-10-1025
10	CLEAR CREEK	Fecal Coliform	20N	03E	11	UP04FV	WA-10-1021
10	CLEARWATER RIVER	Temperature	19N	08E	17	YH060Q	WA-10-1043
10	COMMENCEMENT BAY (INNER)	Dieldrin	21N	03E	99	GK89AF	WA-10-0020
10	COMMENCEMENT BAY (INNER)	Lead				390KRD	WA-10-0020
10	COMMENCEMENT BAY (INNER)	Mercury				390KRD	WA-10-0020
10	COMMENCEMENT BAY (INNER)	Total PCBs				390KRD	WA-10-0020
10	COMMENCEMENT BAY (INNER)	Zinc				390KRD	WA-10-0020
10	COMMENCEMENT BAY (OUTER)	2,4-Diinethylpheno l				390KRD	WA-10-0010
10	COMMENCEMENT BAY (OUTER)	2-Methylphenol				390KRD	WA-10-0010

WRIA	Waterbody Name	Parameter	Township	Range	Section	New ID #	Old ID #
10	COMMENCEMENT BAY (OUTER)	Acenaphthene				390KRD	WA-10-0010
10	COMMENCEMENT BAY (OUTER)	Arsenic				390KRD	WA-10-0010
10	COMMENCEMENT BAY (OUTER)	Benzoic acid				390KRD	WA-10-0010
10	COMMENCEMENT BAY (OUTER)	Benzyl alcohol				390KRD	WA-10-0010
10	COMMENCEMENT BAY (OUTER)	Bis(2-ethylhexyl) phthalate				390KRD	WA-10-0010
10	COMMENCEMENT BAY (OUTER)	Butylbenzyl phthalate				390KRD	WA-10-0010
10	COMMENCEMENT BAY (OUTER)	Cadmium				390KRD	WA-10-0010
10	COMMENCEMENT BAY (OUTER)	Copper				390KRD	WA-10-0010
10	COMMENCEMENT BAY (OUTER)	Di-n-butyl phthalate				390KRD	WA-10-0010
10	COMMENCEMENT BAY (OUTER)	Dibenzofuran				390KRD	WA-10-0010
10	COMMENCEMENT BAY (OUTER)	Diethyl phthalate				390KRD	WA-10-0010
10	COMMENCEMENT BAY (OUTER)	Dissolved Oxygen				390KRD	WA-10-0010
10	COMMENCEMENT BAY (OUTER)	Fecal Coliform				390KRD	WA-10-0010
10	COMMENCEMENT BAY (OUTER)	Fluoranthene				390KRD	WA-10-0010
10	COMMENCEMENT BAY (OUTER)	Fluorene				390KRD	WA-10-0010
10	COMMENCEMENT BAY (OUTER)	Lead				390KRD	WA-10-0010
10	COMMENCEMENT BAY (OUTER)	Mercury				390KRD	WA-10-0010
10	COMMENCEMENT BAY (OUTER)	N-nitrosodiphenyla rnine				390KRD	WA-10-0010
10	COMMENCEMENT BAY (OUTER)	Naphthalene				390KRD	WA-10-0010
10	COMMENCEMENT BAY (OUTER)	Phenanthrene				390KRD	WA-10-0010

WRIA	Waterbody Name	Parameter	Township	Range	Section	New ID #	Old ID #
10	COMMENCEMENT BAY (OUTER)	Phenol				390KRD	WA-10-0010
10	COMMENCEMENT BAY (OUTER)	Silver				390KRD	WA-10-0010
10	COMMENCEMENT BAY (OUTER)	Total PCBs				390KRD	WA-10-0010
10	COMMENCEMENT BAY (OUTER)	Zinc				390KRD	WA-10-0010
10	FIFE DITCH	Ammonia-N	20N	03E	01	ZV38XK	WA-10-1012
10	FIFE DITCH	Dissolved Oxygen	20N	03E	01	ZV38XK	WA-10-1012
10	FIFE DITCH	Fecal Coliform	20N	03E	01	ZV38XK	WA-10-1012
10	FOX CREEK	Temperature	18N	05E	28	PA88SG	None29
10	GREENWATER RIVER	Temperature	19N	09E	11	IT88EW	WA-10-1046
10	GREENWATER RIVER	Temperature	19N	10E	22	IT88EW	WA-10-1046
10	GREENWATER RIVER	Temperature	19N	10E	25	IT88EW	WA-10-1046
10	HYLEBOS CREEK	Fecal Coliform	20N	04E	05	RL09XF	WA-10-1011
10	HYLEBOS CREEK, W.F.	Fecal Coliform	21N	04E	32	BT61HR	WA-10-1013
10	KINGS CREEK	Temperature	18N	05E	34	XK66ZF	None27
10	MEEKER DITCH	Dissolved Oxygen	20N	04E	33	WC64LH	WA-10-1028
10	MEEKER DITCH	Fecal Coliform	20N	04E	32	WC64LH	WA-10-1028
10	MEEKER DITCH	Fecal Coliform	20N	04E	33	WC64LH	WA-10-1028
10	MEEKER DITCH	pH	20N	04E	33	WC64LH	WA-10-1028
10	MEEKER DITCH	Temperature	20N	04E	33	WC64LH	WA-10-1028
10	PUYALLUP RIVER	Arsenic	20N	04E	21	PX29AG	WA-10-1020
10	PUYALLUP RIVER	Fecal Coliform	20N	04E	18	PX29AG	WA-10-1020
10	PUYALLUP RIVER	Fecal Coliform	20N	04E	21	PX29AG	WA-10-1020

WRIA	Waterbody Name	Parameter	Township	Range	Section	New ID #	Old ID #
10	PUYALLUP RIVER	Instream Flow	17N	06E	34	PX29AG	WA-10-1070
10	SCATTER CREEK	Temperature	19N	07E	11	LY34GL	WA-10-1041
10	SOUTH PRAIRIE CREEK	Fecal Coliform	19N	05E	14	VC19MO	WA-10-1085
10	SOUTH PRAIRIE CREEK	Temperature	19N	06E	23	VC19MO	WA-10-1085
10	SUMMIT LAKE	pH	18N	8E	17	588ANI	WA-10-9250
10	SWAN CREEK	Fecal Coliform	20N	03E	11	YA221G	WA-10-1022
10	THEA FOSS (CITY) WATERWAY	PCB-1254	21N	03E	99	GK89AF	WA- 10-0030
10	THEA FOSS (CITY) WATERWAY	PCB-1260	21N	03E	99	GK89AF	WA-10-0030
10	UNNAMED CREEK	Fecal Coliform	20N	04E	29	AD371U	WA-10-1026
10	VOIGHT CREEK	Temperature	19N	05E	33	AG77JE	WA-10-1081
10	WAPATO CREEK	Dissolved Oxygen	20N	03E	01	MM40DB	WA-10-1015
10	WAPATO CREEK	Dissolved Oxygen	20N	04E	16	ZV38XK	WA-10-1015
10	WAPATO CREEK	Fecal Coliform	20N	03E	01	MM40DB	WA-10-1015
10	WAPATO CREEK	Fecal Coliform	20N	04E	16	ZV38XK	WA-10-1015
10	WAPATO CREEK	Instream Flow	20N	03E	01	MM40DB	WA-10-1015
10	WAPATO CREEK	Instream Flow	20N	03E	01	ZV38XK	WA-10-1015
10	WAPATO CREEK	Instream Flow	20N	03E	12	ZV38XK	WA-10-1015
10	WAPATO CREEK	Instream Flow	20N	04E	16	ZV38XK	WA-10-1015
10	WHITE (STUCK) RIVER	Copper	20N	06E	33	LY34GL	WA-10-1030
10	WHITE (STUCK) RIVER	Fecal Coliform	20N	04E	49	LY34GL	WA-10-1030
10	WHITE (STUCK) RIVER	Fecal Coliform	20N	06E	34	LY34GL	WA-10-1030
10	WHITE (STUCK) RIVER	Instream Flow	20N	04E	01	LY34GL	WA-10-1030

WRIA	Waterbody Name	Parameter	Township	Range	Section	New ID #	Old ID #
10	WHITE (STUCK) RIVER	Instream Flow	20N	06E	35	LY34GL	WA-10-1030
10	WHITE (STUCK) RIVER	Mercury	20N	06E	33	LY34GL	WA-10-1030
10	WHITE (STUCK) RIVER	pH	20N	04E	01	LY34GL	WA-10-1030
10	WHITE (STUCK) RIVER	pH	21N	04E	36	LY34GL	WA-10-1030
10	WHITE (STUCK) RIVER	pH	21N	05E	29	LY34GL	WA-10-1030
10	WHITE (STUCK) RIVER	Temperature	21N	04E	36	LY34GL	WA-10-1030
10	WHITE (STUCK) RIVER	Temperature	21N	05E	30	AU19FR	WA-10-1030
10	WHITE (STUCK) RIVER	Temperature	21N	05E	31	LY34GL	WA-10-1030
10	WILKENSON CREEK	Copper	19N	06E	28	NX07HW	WA-10-1087
10	WILKENSON CREEK	Temperature	19N	06E	34	NX07HW	WA-10-1087
11	CATT CREEK	Temperature	14N	07E	18	SG29YL	WA-11-1050
11	CLEAR LAKE	Total Phosphorus	16N	03E	31	650HOS	WA-11-9050
11	CLEAR LAKE	Total Phosphorus	17N	04E	27	792UHY	WA-11-9040

Table E-5: White River tributaries with fish passage problems

Tributary Name	WRIA #	County
Jones Creek	10.0039	Pierce
Bowman Creek	10.0042	Pierce
Unnamed Tributary	10.0059	King
Slippery Creek	10.0118	Pierce
Forest Creek	10.0134	Pierce
Pyramid Creek	10.0143	King
Pinochle Creek	10.0198	Pierce
Viola Creek	10.0199	Pierce
Huckleberrey Ck	10.0253	Pierce
Eleanor Creek	10.0258	Pierce
Slide Creek.	10.0130	King
Minnehaha Creek	10.0300	Pierce
Ranger Creek	10.0308	Pierce
Deep Creek	10.0311	Pierce
Silver Creek	10.0313	Pierce
W. Twin Creek	10.0107	King
E. Twin Creek	10.0109	King